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The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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Germany

The thoughts of many founders and many in the iron and steel industry as a whole are turned just now to Germany and to conditions in that country. It is not too much to say that people in this country have a very great admiration for the scientific achievements of that nation and that they recognise many fundamental similarities between the people of the two countries, their tastes and outlook, feelings tempered by political developments alien to our ideas, freely as we grant the right of any nation to determine its own internal developments. The next International Foundry Congress is to take place in Germany in September, in Düsseldorf, a city for which and of which many have pleasant memories. In parallel with it is to be held a foundry exhibition. Immediately following the Congress is to be held the autumn meeting of the Iron and Steel Institute, for which a very elaborate programme has been arranged. The British Cast Iron Research Association is arranging a short tour of works visits, to end at the time of the opening of the Congress. The programme of Papers and visits will be full of interest, and many will wish to take part.

A report* just issued by the Department of Overseas Trade deals with Germany's attempt to become economically self-supporting. The conclusions are that the vast expenditure on public works and armaments (in part a way of dealing with the unemployment problem) is placing a serious strain on the resources of the country, and that industry is handicapped by the lack of raw material supplies. Anglo-German trade excepted, German imports tend to exceed exports. The lack of raw materials is forcing the country to all sorts of expedients to get them, for in the ordinary way imports can only be paid for by exports. Thus, it is stated that one-fifth of the export trade is done by barter agreements, and three-fifths passes through State clearing accounts. The effect of increased taxation and State expenditure tends to reduce the standard of living of the people. But the miracle of a country apparently defying the laws of economics remains.

The Report is excellent in every way, except for the lack of information about the German foundry industry. From the tables, however, one very interesting fact emerges, namely, that last year Germany made 430,808 metric tons of steel castings. We have confirmed this figure by reference to those issued by the Comité des Forges, and they agree to within 6,000 tons. The United Kingdom production in 1935 was of the order of 190,000 long tons, or about half that of Germany. Related to general steel production, Germany's figure is 2.5 per cent., as against our 2 per cent. It has been said that United Kingdom production of malleable castings per head of population is the lowest of any industrial nation. These two factors taken together give much food for thought. One of our colleagues who has an intimate knowledge of German engineering suggests that the question of obsolescence of machinery is the most important factor influencing this ratio, but we are not convinced that this is the case, and would suggest that the probability is that shipbuilding and armaments carry a higher percentage of steel castings than general constructional engineering.

To us the most fascinating part of the report is that dealing with the organisation of the labour front—the polygamous marriage of politics, trade expansion and welfare work. The "Strength through Joy" organisation is, for instance, associated with the creation of new seaside resorts, the organisation of summer holidays and political directional control.

No matter what personal interests are, something will be found within the compass of the Report to add to one's knowledge of this extremely interesting country. That Germany is interesting can be exemplified by a recent edict issued which insists that all exporting concerns must send to the department dealing with foreign exchange at determined intervals all their germane correspondence and copies of contracts signed and being negotiated. The last phase of the order is necessary so that the wording of the proposed contract may be scrutinised to ascertain whether it conforms with the law. This we candidly admit is an extremely loose detached statement and must, to have any real meaning, be interpreted by relating it to the general scheme of affairs in Germany. The Nazi *régime* has created a new vocabulary related only to national socialism and nothing else. We cannot praise too highly the scholarly and successful attempt made to enlighten the British public on the political and economic structure of the Reich. Much wisdom has been shown in giving a glossary of the new words and phrases which have been coined to meet the new conditions. One which seems curious when detached from the

(*Concluded on page* 76.)

* "Economic Conditions in Germany (to March, 1936)." A Report by E. C. Donaldson Rawlins, C.M.G., C.B.E. Published by H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. (Price 5s. net.)

Pure Iron Constants

The National Physical Laboratory has published "Physical Constants of Pure Metals,"* which deals at some length with pure iron. The iron was prepared by the action of steam on heated ferrous chloride and the resulting oxide reduced with hydrogen. The melting point, accepting the value 1,555 ± 2 deg. for the melting point of palladium, and determined with the optical pyrometer method, was found to be 1,527 ± 3 deg. C. This sample contained 0.010 per cent. carbon, 0.030 per cent. silicon, traces of sulphur and manganese, 0.014 per cent. phosphorus, and 0.05 per cent. oxygen. The density of this iron was 7.871 ± 0.002 gms. per millilitre at 19 deg. C. The coefficient of expansion per deg. C. was 0.000,011,2 ± 0.000,000,5 between 0 and 100 deg. C., and 0.000,012,4 ± 0,000,000,2 between 0 and 250 deg. C. Electrical resistivity in microhms per cub. cm. at 0 deg. C. was 8.8, 14.5 at 100 deg. C. and 21.5 at 200 deg. C. Magnetic tests on a ring specimen annealed for 1 hr. at 1,000 deg. C. and furnace-cooled under high vacuum conditions gave a maximum permeability of 14,360 at a magnetising force of 0.5 oersted. After subjecting the specimen to an initial magnetising force of 15 oersteds the following observations were made:—Remanence (gauss), 8,700; coercivity (oersteds), 0.27$_1$.

Hardness tests were as follow:—Average Brinell on an unannealed specimen using balls of 5 mm. and 2 mm. dia. and loads of 250, 40 and 20 kgs. and a 30 secs. load in all cases was 55. On a severely cold-worked specimen annealed for 2 hrs. at 950 deg. C. giving a large crystal size (2 mm., 20 kgs., 30 secs.) the Brinell was 49, and the diamond pyramid hardness (136 deg., 10 kgs., 30 secs.) was 48.

The following are the results carried out on two coarse-grained, cylindrical (¼ in. dia.) tensile test pieces; approximate limit of proportionality 2.04 and 2.42 tons per sq. in.; ultimate stress, 11.9 and 11.1 tons per sq. in.; reduction of area, 100 and 100 per cent.; elongation, 49 and 36 per cent.; modulus of elasticity (lbs. per sq. in.), 29.7×10^6 and 28.0×10^6. With regard to malleability a reduction in thickness of 99 per cent. was attained by cold rolling, without annealing at any stage.

Transformations were determined as follow:—Delta-gamma, Ac_4 at 1,398 deg. C. and Ar_4 at 1,397 deg. C.; alpha-gamma, Ac_3 range from 924 to 950 deg. C., mean 937 deg. C., and the Ar_3 range from 917 to 905 deg. C., the mean being 911 deg. C., the magnetic or Curie point being on Ac_2 769 deg. C., and Ar_2 767 deg. C.

Germany

(*Concluded from page 75.*)

general organisation and which is related to the Reich Chamber of Culture is "Minister für Volksaufklarüng und Propaganda"—translated as Minister for Popular Enlightenment and Propaganda. Others are "Schönheit der Arbeit"—"Beauty and Labour"; "Amt für Soziale Selbstverantwortung"—Section for Social Self-Administration," and "Betriebsgemeinschaft" for "a firm." Formerly, the German word "Firma" sufficed, but now the new word relates it to the general state of affairs, and means a sort of "get-together establishment." We have given these illustrations as throwing light on a political and social organisation which, as Britishers, we must understand in order to evaluate its worth and future. The whole nation is organised into one vast machine destined to enter into every phase of business activity, home life, and personal recreations.

* H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. (Price 6d. net.)

District Presidents.—No. 4

SHEFFIELD BRANCH OF THE INSTITUTE OF BRITISH FOUNDRYMEN

MR. J. ROXBURGH, President of the Sheffield Branch of the Institute of British Foundrymen, was born in Edinburgh, and educated at Lower School of Lawrence Sherriffe, Rugby. He gained his Inter B.Sc. externally at Birmingham University. After serving his time in the foundries and patternshop of the British Thomson-Houston Company, Limited, Rugby, in 1924 he was appointed assistant foundry manager at the Brightside Foundry & Engineering Company, Limited, Newhall Works, Sheffield. Two years later Mr. Roxburgh was appointed manager of the foundry and patternshop at the same works. In 1932 he became manager of the

MR. J. ROXBURGH.

foundry and patternshop of Newton Chambers & Company, Limited, Thorncliffe Ironworks, Chapeltown, near Sheffield, and in February of this year he took up duties as manager of the foundry and patternshop with Davy Bros., Limited, Sheffield, manufacturers of rolling-mill and steelworks plant, hydraulic and forging presses, and general engineers.

Mr. Roxburgh is the author of numerous lectures and Papers, for which he has been awarded diplomas. He was lecturer on Foundry Practice and Science for two years at Sheffield University evening classes, and is a member of the Sheffield Council and of the General Council of the Institute of British Foundrymen.

Our readers will be interested to learn that Mr. Roxburgh has played football as an amateur for several professional clubs, including Leicester City, Aston Villa, Stoke City and Sheffield United. He has taken part in over 100 League games, and captained his county when they won the Northern Counties Amateur Championship. He has played in North *v.* South games, and gained his Amateur International for Scotland against England in 1926 at Leicester, when Scotland were victorious.

Higher Wages in Scottish Pig-iron Trade

The joint secretaries of the Scottish Pig-iron Trade Board report that the certified returns for April, May, and June, 1936, made by the employers show an average net selling price of £3 9s. 4.780d. per ton. This means that there will be an increase of 3 per cent. in the wages of the workmen on basis rates.

Import Trade of India

A pamphlet entitled "Survey of the Import Trade of India for the Fiscal Year April 1, 1935, to March 31, 1936," prepared by His Majesty's Senior Trade Commissioner in India, has been issued by the Department of Overseas Trade. Appended are some extracts which will be of interest to our readers. (Rupees 1 lakh (Rs. 100,000) = £7,500 at 1s. 6d. exchange. Rupees 1 crore = Rs. 100 lakhs = £750,000.)

Machinery and Millwork.—The imports of oil engines and parts rose from Rs. 68 lakhs to Rs. 69 lakhs, which shows that there has been no check to the industrial revival. Arrivals of electrical machinery rose from Rs. 169 lakhs to Rs. 205 lakhs. The United Kingdom share advanced from Rs. 122 lakhs to Rs. 138 lakhs, that of Germany from Rs. 21 lakhs to Rs. 29 lakhs, the U.S.A. from Rs. 12 lakhs to Rs. 16 lakhs and other countries from Rs. 14 lakhs to Rs. 22 lakhs. As regards boilers, United Kingdom supplied Rs. 58 lakhs out of a total of Rs. 77 lakhs, Germany providing Rs. 2½ lakhs and unenumerated countries Rs. 16 lakhs. Metal-working machinery, which includes machine tools, rose from Rs. 14 lakhs to Rs. 18 lakhs, the British share rising from Rs. 9½ lakhs to Rs. 12½ lakhs, Germany from Rs. 2 lakhs to Rs. 3½ lakhs, while that of U.S.A. declined from Rs. 2½ lakhs to Rs. 1½ lakhs. Mining machinery, to a total of Rs. 41 lakhs, was supplied by the United Kingdom (Rs. 16 lakhs), Belgium (Rs. 11 lakhs) and the U.S.A. (Rs. 11½ lakhs). A decline took place in the imports of cotton textile machinery, from Rs. 241 lakhs to Rs. 200 lakhs and the United Kingdom share was reduced from Rs. 210 lakhs to Rs. 163 lakhs. Imports from Germany rose from Rs. 13½ lakhs to Rs. 17 lakhs, from Japan from Rs. 4 lakhs to Rs. 4½ lakhs, while arrivals from Italy and the U.S.A. remained stationary at Rs. 3 lakhs. Arrivals of sugar machinery fell sharply with the conclusion of the boom in the erection of sugar plants, from Rs. 105 lakhs to Rs. 66 lakhs. Imports from United Kingdom fell from Rs. 73½ lakhs to Rs. 49½ lakhs, but the percentage rose from 70 to 75. Arrivals from Holland fell from Rs. 7 lakhs to Rs. 1 lakh and those from Germany from Rs. 11½ lakhs to Rs. 10¾ lakhs.

Aluminium.—The total imports increased from 52,467 cwts. valued at Rs. 38 lakhs to 63,516 cwts. valued at Rs. 45 lakhs. Wrought circles accounted for the bulk of this trade and the volume of imports increased from 41,171 cwts. valued at Rs. 27¾ lakhs to 51,990 cwts., valued at Rs. 34½ lakhs.

Cast Pipes and Fittings.—This trade fell from 1,581 tons (Rs. 6.9 lakhs) to 1,357 tons (Rs. 6.8 lakhs). The United Kingdom tonnage was reduced from 1,455 tons to 1,273 tons, but the value remained stationary at Rs. 6.4 lakhs.

Hardware.—There was a satisfactory increase in this trade and the value of imported enamelled iron ware increased to Rs. 19 lakhs as compared with Rs. 17 lakhs 1934-5, whilst the value of imported stoves remained the same as for the previous year at Rs. 4¾ lakhs.

Catalogue Received

Cleaning Apparatus. The Constructional Engineering Company, Limited, of Titan Works, Charles Henry Street, Birmingham, 12, have nearly overcome our well-known prejudice against folders by issuing one dealing with the "Sand Wizard" method of cleaning castings and the like which involves the use of centrifugal action instead of compressed air. In the first place, it is sensibly folded and it certainly does give sufficient technico-economical information to whet the appetite for more details. The extracts from users' opinions are very convincing.

The Manufacture of Intricate Thin-Walled Steel Castings*

By R. HUNTER, B.Sc., Ph.D., and J. McARTHUR

(*Concluded from page* 65.)

Gear Case

Figs. 15 and 16 show views of top and underside of this casting. The thickness of the metal in the body and webs is $\frac{3}{8}$ in. and $\frac{5}{16}$ in. respectively. It will be observed that the upper side, despite its intricate nature, does not necessitate a great deal of core work, although it certainly involves a high degree of moulding skill. The construction of the underside, however, makes the use of a considerable number of cores essential.

Figs. 17 and 18 show the cope and drag respectively. Core prints and bottom of the main flange only are left in the drag, and the green and partially-dried cores assembled in position are shown in Fig. 19. This procedure enables any minor adjustments in the cores to be readily made, and so greatly reduces the total closing-time which would otherwise be necessary if the cores were assembled in the dried condition. Owing also to the number of cores to be assembled on the drag, a considerable amount of sealing is necessary to avoid fins, and this procedure ensures thorough drying at all such points.

The exceedingly complicated nature of the cope will be observed in Fig. 17 and the few cores that are necessary are placed in this portion of the mould before drying. The method of running this casting will be seen in this illustration. Two gates leading from a common down runner are attached to the bottom edge of the smallest flange as shown at the bottom left-hand corner.

The cores assembled in the drag of this mould are made in several different ways. The large cores are reinforced by cast-iron grids and are made entirely of facing sand. On the heavier sections of these cores the venting is carried out by a series of pricked holes extending inwards as near to the surface of the core as possible. These holes radiate from channels cut in the underside of the cores and provision is made for the gases to escape downwards through the drag. A number of the large cores, however, are reduced in section to about 1 in. thick in parts. It is not practicable, therefore, at such points to have pricked holes for vents, and consequently in such places the cores are wax-vented. When this procedure is adopted, of course, the cores are partially dried to allow the wax to run out before assembly on the drag. The numerous small cores are reinforced with bent wire and are either pricked for venting or wax-vented.

The principal machining-faces on this casting, it will be observed, are cast face downwards, and fortunately the shape of the casting does not make the adequate feeding of such parts difficult. The numerous and substantial nature of the feeding heads, however, will be noted in Fig. 20.

Nozzle Segment

Fig. 21 shows this casting complete with head and runner. The shape of the flange of the casting is as indicated. The principal difficulties in the production of this casting are the running of the extremely-thin metal of only $\frac{1}{8}$ in. in thickness, separating adjacent nozzles, and the accuracy of the location and shape of the nozzles. Fig. 22 shows the cope and drag of the mould. The core assembly in position in the drag is shown in Fig. 23. All cores are made in oil sand.

The principal reason for casting the segments on edge is that the cores suffer the minimum of distortion by the molten metal when placed this way. Accurate assembly of the cores is naturally of paramount importance. To attain this, a wooden jig is provided which is located by means of the print shown in the core in Fig. 24. The top prints of the nozzle cores are registered with suitable marks on the circumference of the jig, while the bottom prints are located in the semi-circular recess. The vents for the nozzle cores will also be observed leading from the bottom of the recess. The nozzle cores, partly assembled, will be seen in Fig. 25.

FIG. 15.—TOP VIEW OF A GEAR-CASE CASTING.

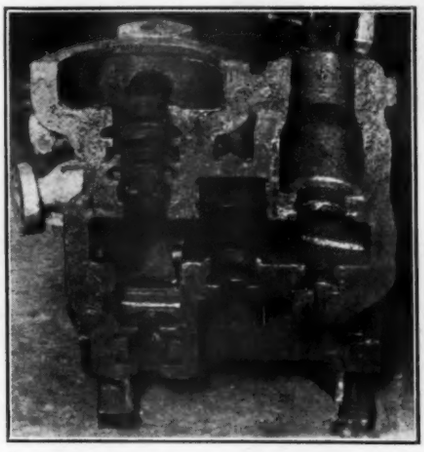

FIG. 16.—INTERNAL ASPECT OF A GEAR-CASE CASTING.

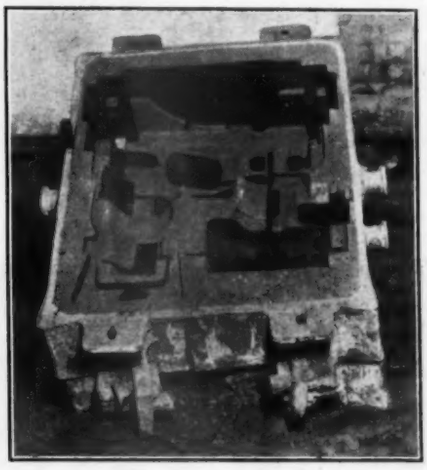

FIG. 17.—COPE HALF OF GEAR-CASE MOULD.

FIG. 18.—DRAG HALF OF GEAR-CASE MOULD.

FIG. 21.—NOZZLE SEGMENT CASTING WITH HEAD AND RUNNER.

FIG. 19.—CORES ASSEMBLED IN GEAR-CASE MOULD.

Fig. 20.—Feeding Arrangements for Gear-Case Casting.

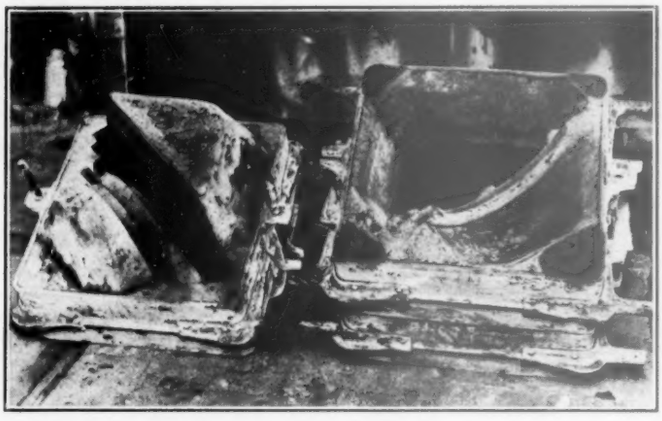

Fig. 22.—Cope and Drag Half Moulds for Nozzle Segments.

Fig. 23.—Core Assembly for Nozzle-Segment Castings.

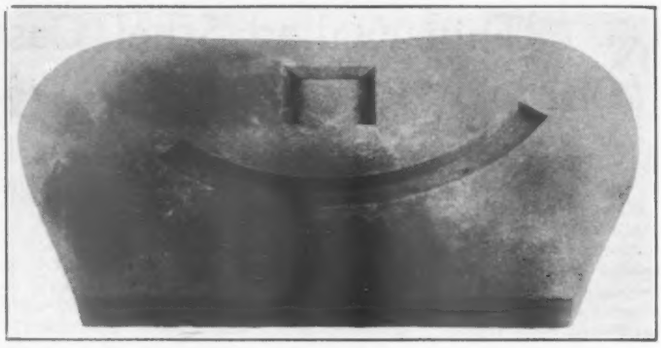

Fig. 24.—Core for locating Wooden Jig for Nozzle Core Assembly.

Fig. 25.—Nozzle Cores partly assembled.

Fig. 26.—Combined Oil-Engine Bedplate and End Casing.

Fig. 27.—Internal Aspect of Casting shown in Fig. 26.

Combined Oil Engine Bedplate and End Casing

General views of this casting are shown in Figs. 26 and 27, whilst longitudinal and transverse cross-sections are given in Fig. 28. The casting is roughly 11 ft. long by 3 ft. wide by 3 ft. deep at the sump end and weighs about 38 cwts. The thickness of the metal in the body and the webs supporting the bearings is ½ in. which in proportion to the size of the casting is extremely light as will be appreciated from Fig. 28. The principal difficulties arising in the production of this casting are:—(1) The successful running of such a large area of thin metal; (2) prevention of hot-tears, and (3) maintenance of size.

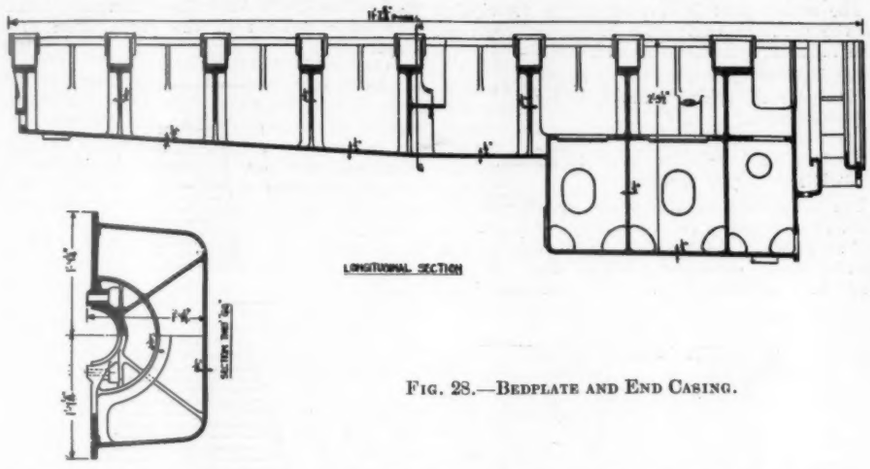

FIG. 28.—BEDPLATE AND END CASING.

From a consideration of the various factors influencing the choice, it was decided to mould the casting with the bearing pads and the horizontal flange encircling the body face downwards. The pattern as placed on the drag is shown in Fig. 29, which at the same time shows the method of running and gating the casting. The numerous small heads placed where required are represented by wooden blocks.

To prevent hot-tearing, the main cores were made in such a manner that while they were sufficiently robust to withstand the action of the liquid metal, they offered little resistance to crushing by the contracting casting. Means were also provided whereby the main core irons could be readily shattered at the desired lapse of time after casting.

An illustration showing a typical core-iron assembly is seen in Fig. 30. The cast-iron grid-base into which also are cast steel wires bent to follow the external contour of the core will be noted. The long cast-iron fingers projecting from the grid add extra rigidity to the core without unduly affecting the resistance of the sand shell to crushing. At the same time, they provide a ready means of breaking up the core as a whole when the base grid has been shattered. Fig. 31 shows a cross-section of a typical core. To facilitate manufacture, the centre is filled with clean riddled ashes which are removed after the core is dried. It will be observed that the core-iron grid is located in the core-print, and consequently does not interfere with the free contraction of the casting. The cores at the deeper sump end are similarly constructed. The top cores are, however, made separately and located by prints engaging with corresponding recesses in the lower cores.

It will be noted from the transverse sections in Fig. 28 that the bearing pads are considerably heavier than the walls of the casting, and consequently since it is not possible to add a feeding head at these points, external chills have to be used. The soundness of the main-bearing bolt-holes is ensured by the insertion of a mild-steel bar which is subsequently removed by machining.

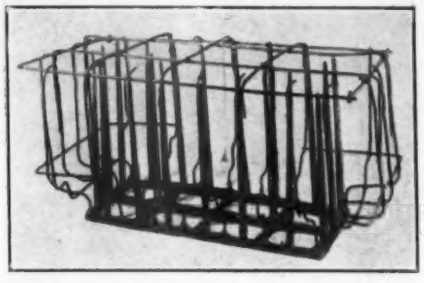

FIG. 30.—CORE-IRON ASSEMBLY.

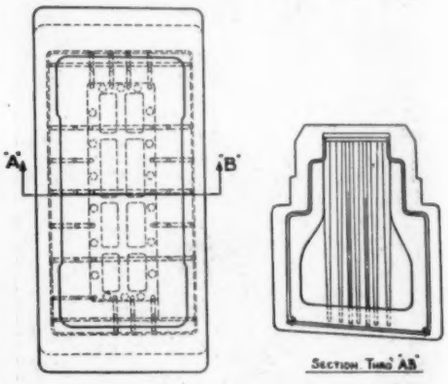

FIG. 31.—MAIN CORE FOR BEDPLATE.

The main cores were made to possess the minimum resistance to crushing, and provision was made that they could be easily shattered immediately after casting. A cross-section of the main cores is illustrated in Fig. 35. The horizontal cross-section "AB" shows how the suitably-shaped wires are located by the vertical iron casting with L-shaped ends. Outside these wires is placed the wire netting which serves to reinforce the facing sand. While the thickness of the sand in these cores naturally varies from point to point, it is never more than 2 in. In making these cores, the centre is supported by riddled ashes, which are removed after the core is dried.

Diesel Engine Crankcase

Figs. 32 and 33 are illustrations of the eight-cylinder crankcase, while Fig. 34 is a cross-section. The main body is ⅜ in. thick, while the webs are only 0.3 in. in thickness. The length is over 7 ft. and the height about 2 ft. 10 in. The extremely complicated nature of this casting will be observed, and the difficulties associated with the successful manufacture will be appreciated. The casting was moulded upright as shown in Fig. 34. A single down-runner was situated at one end, and from it three pairs of runners were connected to the side walls at the bottom, middle and top of the casting.

The shaped ends of the castings carrying the wires are butted together, as shown, so that a blow delivered at the top will readily shatter both cores. The actual moulding is carried out in a perfectly straightforward manner, but provision is made that the mould can be readily shattered and disassembled in order that it will

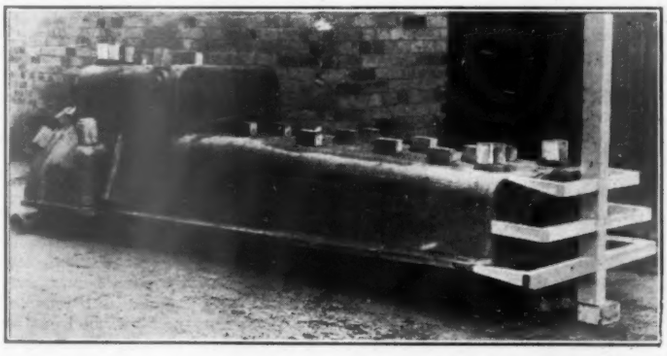

FIG. 29.—PATTERN FOR THE OIL-ENGINE BEDPLATE AS PLACED ON DRAG.

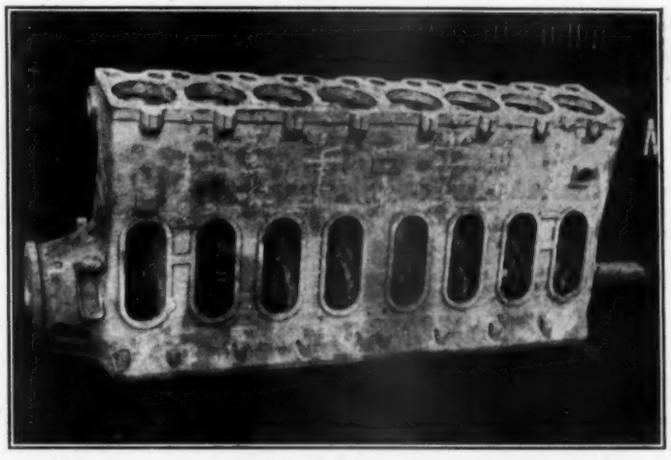

FIG. 32.—EIGHT-CYLINDER CRANKCASE CASTING.

not interfere with the contraction of the casting. As soon as the casting has been poured, two men, starting at the end remote from the runner, shatter the main cores by striking the central supports at the top. As soon as this is done, the mould is shattered and the casting released.

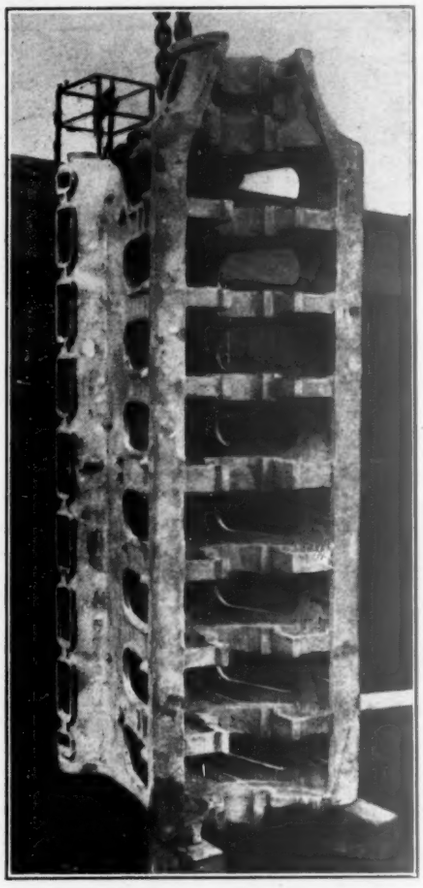

FIG. 33.—INTERNAL VIEW OF THE DIESEL-ENGINE CRANKCASE CASTING.

Summary

This Paper may be conveniently divided into two parts. The first section deals with the various phases of steel foundry practice, with particular reference to thin walled steel castings. Each of these factors has been considered from a general standpoint, and only the underlying principals have been outlined.

The second part is devoted to the description of the actual manufacture of typical castings. The following castings are described:—

(1) Horizontal turbine pump framing.
(2) Vertical turbine pump framing.
(3) Gearcase.
(4) Nozzle segment.
(5) Combined bedplate and end casing.
(6) Diesel engine crankcase.

The difficulties in production peculiar to the various examples are considered, and the expediences which have proved successful in overcoming them described. While these descriptions have necessarily been brief, the underlying reasons for the adoption of the various methods have been in particular emphasised.

The authors wish to take this opportunity of expressing their gratitude to G. & J. Weir, Limited, and to The English Electric Company, Limited, for permission to publish photographs illustrating castings of their designs. They also wish to thank the various members of the staff of the Clyde Alloy Steel Company, Limited, who have assisted in the preparation of this Paper.

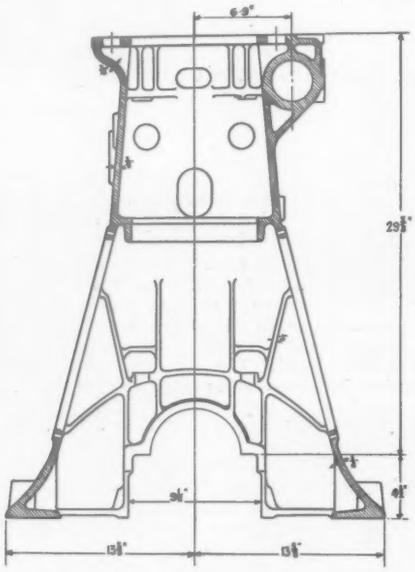

FIG. 34.—CROSS-SECTION OF DIESEL ENGINE CRANKCASE.

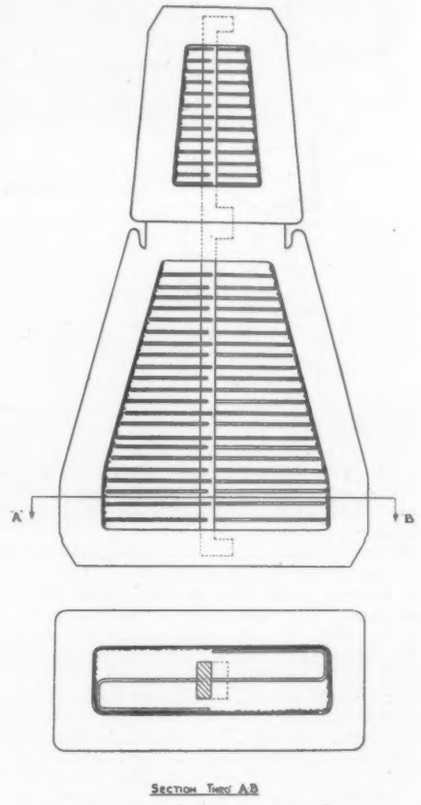

FIG. 35.—MAIN CORES FOR CRANKCASE.

The Phenomena of Capillarity in the Foundry

The Paper entitled "Capillarity as a Factor in Foundry Practice,"* presented by Prof. A. Portevin and Dr. Paul Bastien to the Annual Conference of the Institute of British Foundrymen in Glasgow, gave rise to an interesting discussion.

MR. V. C. FAULKNER (Past-President), who was asked by the President, in the absence of the authors, to put the points of the Paper before the conference, explained that it had been exceedingly difficult to translate the Paper into English. Actually in the translation the word "searching" had been coined. The translator, to whom he desired to pay a compliment, had adopted that expression, being cognisant that the authors were speaking of the property of a metal which caused the erosion of the mould and consequently the scabbing of the casting. He would be very glad, personally, if members could find a better word than "searching." He felt that this was the kind of Paper that needed a serious amount of study, and he invited the more practical members to examine it carefully. He thought that some of the conclusions that the authors had drawn were quite capable of being interpreted by the ordinary man in charge of the shops.

MR. BEN HIRD confessed that he had not had an opportunity of really seriously studying the Paper, but he was pleased that someone had taken up this matter of capillary attraction in the foundry. He had not sufficient scientific knowledge to discuss the matter on the lines that the authors had laid down, but from a practical point of view it was a matter that he had had in mind for a considerable time. As a foundryman he was sure that the study of the way in which metal filled a mould by a rolling action was very important, and it would be very wise for them firmly to fix this matter in their minds when studying some of their foundry problems. Personally, he felt such a study was well going to repay further research, both from the practical point of view and from the more academic standpoint.

The Word "Searching"

DR. J. W. DONALDSON said he had not had time to study the Paper in detail, but he could see that the authors had carried out a very important investigation on the surface properties of metals and of oxidised and unoxidised aluminium in particular. He was interested in what was said with regard to wetting and "searching," as he had carried out experiments on the frictional properties of oils and had found that wetting and adsorption by oils of a metal surface was an important factor in lubrication. He would suggest that the term "adsorption" as adopted by Longmuir for the penetration of the molecules of a metal surface by the molecules of an oil might be used in place of the term "searching," as there was a certain similarity between the two phenomena. Wetting and adsorption of metallic surfaces by oils gave the best conditions for satisfactory lubrication, whereas wetting and adsorption, or "searching," by the surface films of molten metals had a deleterious effect on mould surfaces. The production, therefore, of surface films which had non-wetting properties was important, and the authors had shown that such films resulted with small additions of aluminium. The investigation as carried out by the authors was of a highly scientific nature, and the fact that it added to the knowledge of the physical properties of metals was of value, as all such physical data were of ultimate use and advantage to the practical foundryman, and he therefore considered the members of the Institute should be grateful to the authors for their contribution.

In a written communication MR. FAULKNER pointed out that the French word for adsorption was the same as English. The word used in the French text was "abreuvage."

* FOUNDRY TRADE JOURNAL, July 9, page 28.

Fiftieth Anniversary of the Cathcart Works of G. & J. Weir, Limited

By P. FOX-ALLIN

This year marks the 50th anniversary of the establishment of the Cathcart Works of Messrs. G. & J. Weir, Limited, and in celebration of the event the company gave the whole of their workmen a Saturday free on full pay in addition to which every employee over 21 years of age received 10s., whilst those under 21 years of age were given 5s.

Although the Cathcart Works were not established until 1886, the firm was actually founded in the early 'seventies by the brothers James and George Weir, with offices in Hydepark Street, Glasgow. Prior to this time Mr. James Weir had patented a number of useful inventions, notably starting valves for compound engines, the hydrokineter boiler circulator and a variety of feed heaters. The firm acted as superintending engineers for several well-known houses, and the offices were moved first to Jamaica Street and then to Commerce Street, Glasgow.

Mr. James Weir became greatly interested in the problem of corrosion in marine boilers and carried out a great deal of research work on this subject, with useful practical results, the outcome being the evolution of the Weir de-aerating contact feed heater which largely solved the corrosion problem by rendering the feed water innocuous. It may be recalled that boilers at that time were fed by main engine-driven feed pumps, but it was found that these were unable to handle the hot de-aerated feed satisfactorily. After further investigation the automatically-controlled direct-acting feed pump was produced, and this, in combination with the heater soon aroused general interest in marine circles, so that it speedily became necessary to concentrate on the production of these units of plant, the outcome being the erection of the Cathcart Works, which, it may be noted, were laid out for highly specialised production, at a time when there was little specialisation in this branch of engineering. Soon after the establishment of the Cathcart Works the first marine evaporators were designed and built for the merchant service, and, proving entirely successful, were adopted by H.M. Navy and fitted in a large number of warships.

A vast amount of research work was continuously carried on over a period of many years by the late Mr. James Weir, on such problems as the elimination of corrosion in boiler and feed systems due to the presence of air and gases in solution in the feed water; the various factors influencing condenser performance and the production of vacua, and the advantages of feed heating. To-day, testing, research and experimental work are as rigorously pursued as ever, and it should be realised that the enormous advances which have been made in steam engineering during the last decade or so have been made possible largely by the progress made with the all-important auxiliaries.

The firm was converted into a limited liability company under the present style in 1895. Steady development continued up to and right through the period of the war. Mr. James Weir died in 1920, since when the company has been under the chairmanship of his son, the present Lord Weir. The present board of directors includes:—Messrs. J. R. Richmond and C. R. Lang (joint managing directors), Mr. James Weir, Mr. John Craig. Mr. J. R. Lang (works manager), the Hon. Kenneth Weir, Mr. H. Hillier, Mr. M. L. Jamieson and Mr. J. Spittal. The works as they stand to-day are one of the most extensive devoted to the production of pumps and power plant auxiliaries in this country, covering some 17 acres.

The shops are arranged on either side of a road running through the plant, with the foundry, pattern shop, smithy, sheet-metal and welding shops and power house on the right, with the main machine shops and erecting shops on the left. The machine and erecting shops are covered by 15 bays varying from 600 to 800 ft. in length, with another 15 bays of varying lengths adjoining on a higher ground level. The works manager's and general control offices are situated right in the centre of the works and include the production, rate-fixing, progress and service departments. Each section of the works has its own time office, which attends to all time, bonus and progress work relating to the section.

Taking the sections in order, the Standard Pump section covers the complete machining and erecting of direct-acting feed, service and oil pumps. The work is carried out on a line-production basis, castings arriving at one end of the machine-tool line being progressed through boring, facing, drilling, studding and testing operations, and the pumps erected in batches in lines as they are progressed through the section. Production lines from other parts of the shop converge here, bringing complete units such as steam-valve chests, etc., and as the pumps near the end of the erection bays they are completed and made ready for steam tests, which are carried out at the end of the line.

A series of flexible steam, exhaust, suction and discharge water connections is arranged along the test bed and all pumps are progressed through a regular series of tests for capacity, steam consumption, etc., before being passed for cleaning and painting. Stocks are carried of all the most commonly used sizes of pumps so as to facilitate prompt delivery.

Next to the standard pump section are the general machine-shop bays and the section known as the "factory," for batch production of parts; the equipment includes batteries of automatics, capstan lathes, milling machines, and a full range of up-to-date machine tools. The next is a complete section devoted to the machining and erection of heat-exchange apparatus, including feed-water heaters, auxiliary condensers, drain coolers, heat exchangers for oil and multi-stage air ejectors incorporating interstage coolers, etc.

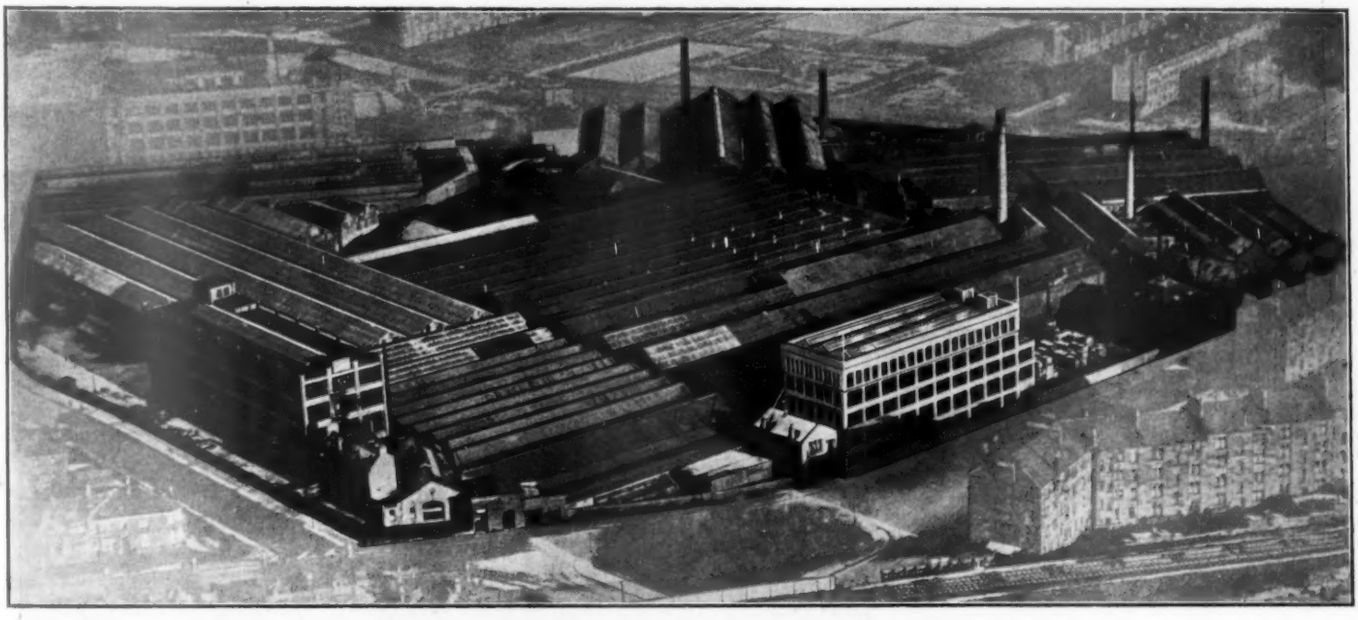

FIG. 1.—AERIAL VIEW OF THE CATHCART WORKS OF G. & J. WEIR, LIMITED.

Another bay is devoted to the erection of air pumps, multi-throw plunger pumps, etc., and yet another to the erection of high-pressure air compressors. A heavy machine-tool bay includes several large roundabouts and boring machines, after which come a despatch bay and warehouse and the main test house, where all special pumps and other gear are given tests under actual working conditions before leaving the works. On the higher level are situated the complete turbine, machine, fitting and erection bays, where the various types of turbine and electrically-driven centrifugal pumps, including feed pumps, condensate extraction pumps, hot and cold oil pumps and turbine-driven oil pressure pumps are built.

A large section is devoted to the manufacture of piston valve chests of the Weir patent design, which is so well known a feature of the Weir

direct-acting pumps. Production is on the line principle and the work is fully jigged. Standard-design steam chests are produced in large batches for all sizes of direct-acting pumps and are conveyed to the central stores ready for issuing to the pump erection department as required.

Near the centre of the main bays are situated the tool room and work planning department, by 40 ft. wide, and alongside again is situated the smithy and steel stores. The smithy equipment includes a hydraulic press, a range of steam and air hammers and a battery of drop stamps.

In the main test shop provision is made for testing electrically-driven centrifugal pumps at all voltages up to 6,600, 50 cycles, by means of a specially-tapped transformer, and for powers

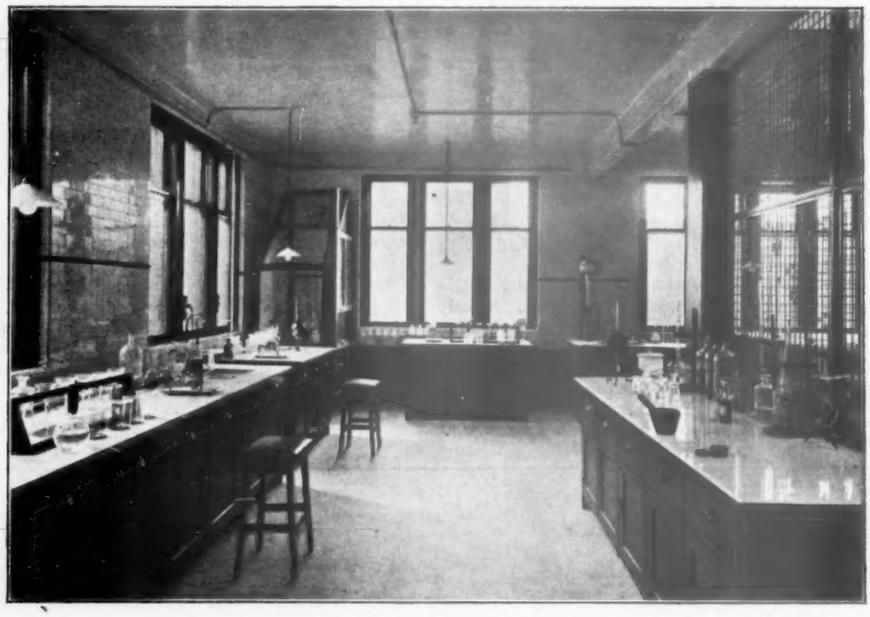

FIG. 3.—VIEW IN CHEMICAL LABORATORY.

which includes a drawing office for jigs and tools, tool room, general tool store, jig store and inspection department. The latter is well equipped with up-to-date apparatus for fine gauge work and checking of all kinds, including a projection apparatus by means of which screw thread forms and small form gauges may be examined by projecting their images, 50 times enlarged, on a screen. The equipment includes a Newall measuring machine, Zeiss thread-measuring machine, Rockwell testing machine, etc. A precision jig boring machine by Société Génevoise is housed in a special room.

A heat-treatment department is equipped with the latest design of furnaces, all heated by gas with the exception of a special electric furnace for the heat-treatment of special parts such as homogeniser valves, etc. The oil for the quenching tanks is circulated through coolers supplied with river water. It has always been the policy of the company to maintain the machinery at the most efficient pitch, and machine tools, regardless of their condition, are replaced by more modern and efficient tools immediately an economic case can be made out for the new equipment.

Recent additions include a Louden electrically-driven planer, capable of a cutting speed of 300 ft. per min.; tungsten-carbide tool steels are used wherever possible. A number of hydraulically-operated tools, includes a shaper and a honing machine, used for the finishing of cylinder bores and air-compressor liners, Churchill "Hydromatic" and Churchill grinder with the new type "Hydrauto" bearing; also a horizontal boring mill with prismatic slides and "Hydrauto" bearing. All machine tools are being equipped with individual drives.

Shop transport is by means of petrol-driven trucks combined with lift skips, whilst all bays are fully equipped with cranes ranging from 2 to 5 tons capacity, excepting in the heavy machine bay where a crane of 30 tons capacity is in service. The sheet metal, welding shops and coppersmith shops are adjoining, each with bays 300 ft. long

up to 1,200 h.p. Special motor-generator plant in the power house provides for the testing of direct-current motor units at all voltages up to 550.

Steam at 350 lb. per sq. in., 625 deg. Fah., for testing is provided by a pair of Babcock & Wilcox watertube boilers each of 12,000 lb. per hour rating, and one Stirling 5-drum boiler of 17,000 lb. per hour normal rating.

A very fully-equipped laboratory includes both physical and chemical sections, where all raw materials are tested and controlled. Included in the equipment is a 50-ton Olsen tensile machine, Izod, Brinell, Erichsen machines, etc., electric furnaces for heat-treatment work, sub-standard electrical instruments for checking works pyrometers and other gear; Vickers metallurgical microscope, dark room, etc.

A carefully-planned apprentice-training scheme is in operation. Apprenticeship commences at the age of 16 or after, and every apprentice must undertake to attend regularly a three years' course of evening classes under a scheme mutually agreed upon by the management, the parents or guardian and the apprentice, under the guidance of the apprentice-training superintendent.

In addition apprentices attend the works school during working hours for a number of weeks during every year of apprenticeship. Here they have the opportunity of studying the design, construction and methods of manufacture of the company's products and their relation to complete power plants. The course is planned in relation to the usual evening school curriculum, and acts as a connecting link between the practical shop work and the academic. A section of one of the large shops is set aside for the practical training of apprentices, chipping, filing and other hand work being taught here before the boys enter the production shops.

THE FOUNDRIES

The demands of the works for castings both ferrous and non-ferrous are met by two foundries. Some few years ago the original Cathcart foundry had reached its limit of output and the best means of expansion received very careful consideration, whilst space was available adjacent to the old foundry, the site was handicapped by the impossibility of connecting sidings with the railway. Further, the ever-widening field of the company's activities made it imperative to provide space for future requirements. It was therefore determined completely to reorganise and mechanise so far as possible the existing foundry at the Cathcart works and to devote it entirely to the production of the heavier castings and more especially special jobs and those required in small numbers, and to build an entirely new foundry for the production of the smaller castings in quantities.

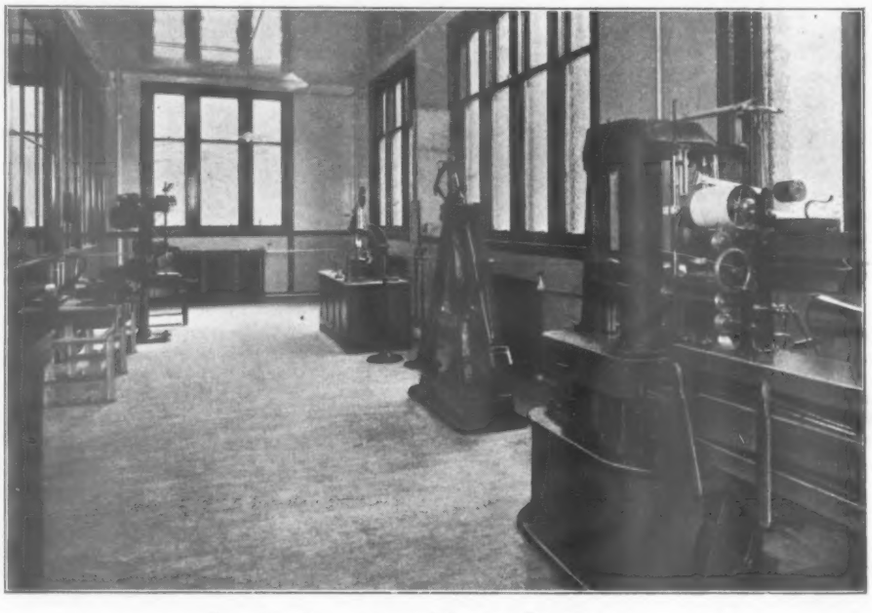

FIG. 4.—VIEW IN THE PHYSICAL LABORATORY.

The situation of the new foundry is Thornliebank, about two miles distant from Cathcart. The land acquired makes very adequate provision for future extensions, whilst it has the advantage of direct connection with the railway.

The Cathcart Foundry

The work of reconstruction in portions of the foundry is still in progress; it is of necessity a matter of time, because the work must perforce be carried out whilst the output of the foundry as a whole is maintained. The absence of railway sidings is admittedly a serious handicap, which, however, has been largely negatived by the evolution of an excellent system of handling and storage. The works are served with a fleet of end-tipping motor lorries which bring in the pig-iron, sand, coke, etc. The lorries are run direct on to a 20-ton electrically-operated hoist which raises them to a platform above a battery of 20 steel hoppers which are arranged for the storage of sand, coke and other additions. The pig-iron is delivered at foundry-floor level and is discharged into one of 14 bins by means of a 2-ton magnet crane, by the Rapid Magnetting Machine Company, Limited.

Sand-Handling and Sand Preparation.—Moulds are knocked out on a grid, the sand falling through on to an inclined apron conveyor which discharges direct into a revolving screen in connection with which is a dust-extraction plant. The screen removes the larger pieces of metal and refuse and the through material is delivered by belt on to a Rapid magnetic separator from which the cleaned sand falls into the boot of an elevator which discharges into an 18-ton storage hopper; feed is taken from this hopper into the 2,000-lb. measuring bucket of the Simpson machine, supplied by August's, Limited, of Halifax. At this point new sand is added as required; in the meantime the sand is brought from the storage bunkers to the foundry in barrows. The 8-ft. Simpson mixer is fitted with a Glenfield & Kennedy water meter to maintain control of the moisture content. The mixer is furnished with two discharge openings each fitted with a sand aerator. One discharge from the mixer delivers into boxes for general foundry use and the second, fitted with a rotary table and plough, discharges into a bucket elevator which in turn discharges into one of the two 10-ton storage bunkers from which the supply is drawn for the Sandslinger.

The Sandslinger is of the tractor type with sand hopper attached; it travels a line of track at right angles to the main bays and having a length of arm of 20 ft. it is able to work on a 40-ft. radius.

All cores are hand made, sea sand being mainly employed. There are four stoves for the general run of cores and a further four stoves for the larger cores and loam cores, the smaller stoves being rack charged and the larger bogie charged. Each battery of four stoves is heated from one coke-fired furnace which is charged from an overhead hopper, the hopper forming a reservoir for carrying sufficient fuel to maintain the furnaces throughout the night. The mould drying stoves are of unique design, being built much on the lines of steelworks soaking pits, for top charging by means of the shop cranes. The stoves are installed in two batteries each consisting of two stoves 22 ft. by 14 ft. by 7 ft. deep. They are heated on the same system as the core stoves from independent furnaces.

In the dressing shop there are two 12-ft. Tilghman's sand-blast cabins which are provided with Spencer & Halstead dust-extraction plants. Pneumatic chippers and hammers are installed throughout and the shop is supplied with a dual service of compressed air, low pressure for the sand-blast plant and for cleaning moulds and high pressure for the pneumatic tools.

Obviously the general run of castings are of medium weight, but castings up to 8 tons are made.

FIG. 5.—LOADING CRANE AND STOCK BINS IN FOUNDRY.

FIG. 6.—VIEW IN THE BOILER HOUSE SHOWING B. AND W. WATER-TUBE BOILER WITH CHAIN-GRATE STOKER.

CATHCART WORKS OF G. & J. WEIR, LIMITED.

Coke and pig-iron are loaded into a bottom-discharging skip of one-ton capacity which is mounted on the platform of an Avery weighing machine. The skip is picked up by a Heywood charging machine and charged direct into the cupolas, no material whatever being carried on the cupola charging platform and charged direct.

The melting plant comprises two cupolas each of 8 tons capacity, fitted with receivers and a small 1-ton capacity cupola, blast being supplied by Keith Blackman fans. Metal is poured into ladles of 2- and 5-ton capacity.

The iron foundry is covered by four bays 320 ft. in length, of these three are 35 ft. wide and one 42 ft. wide. The building is lofty and very liberally top lighted. The whole of the floor, except for the part laid off for the casting pit and a section in the dressing bay for turning large castings, is laid with concrete and throughout there is an orderly cleanliness which is very pleasing.

The bays are laid off respectively for dressing and green-sand moulding served by a 5-ton and a 10-ton crane. The core-making, closing and moulding bay is served by 20-, 10- and 5-ton cranes respectively. The bay for the core-making, storage and sand preparation is served by a 20-ton and a 5-ton crane, while the bay for heavy moulding and loam cores is equipped with two 25-ton and one 10-ton crane.

Non-Ferrous Foundry

The non-ferrous portion of the foundry is still in a state of transition. The old foundry has been entirely dismantled and the new disposition of the plant provides for the production of castings in Monel metal, gunmetal, nickel and aluminium alloys and numerous other special alloys.

The melting plant comprises a 10-cwt. electric furnace which is exclusively employed on Monel metal; five oil-fired Morgan tilting furnaces of 300 and 600 lb. capacity which are employed in melting Monel metal and nickel alloys; four coke-fired Morgan furnaces each of 400 lb. capacity on gunmetal and bronzes; four pit fires each for 200-lb. pots for special alloys and a 2-ton air furnace for general purposes. When the reconstruction is completed, handling will be simplified and facilitated, and a department will be created for the casting of Monel metal impellers only.

Argus Foundry (Thornliebank)

The Argus Foundry (Thornliebank) is built on the most modern lines and is devoted solely to

Fig. 7.—Light Machine Moulding Bay, Argus Foundry.

Fig. 8.—Medium and Light Core Shop, Argus Foundry.

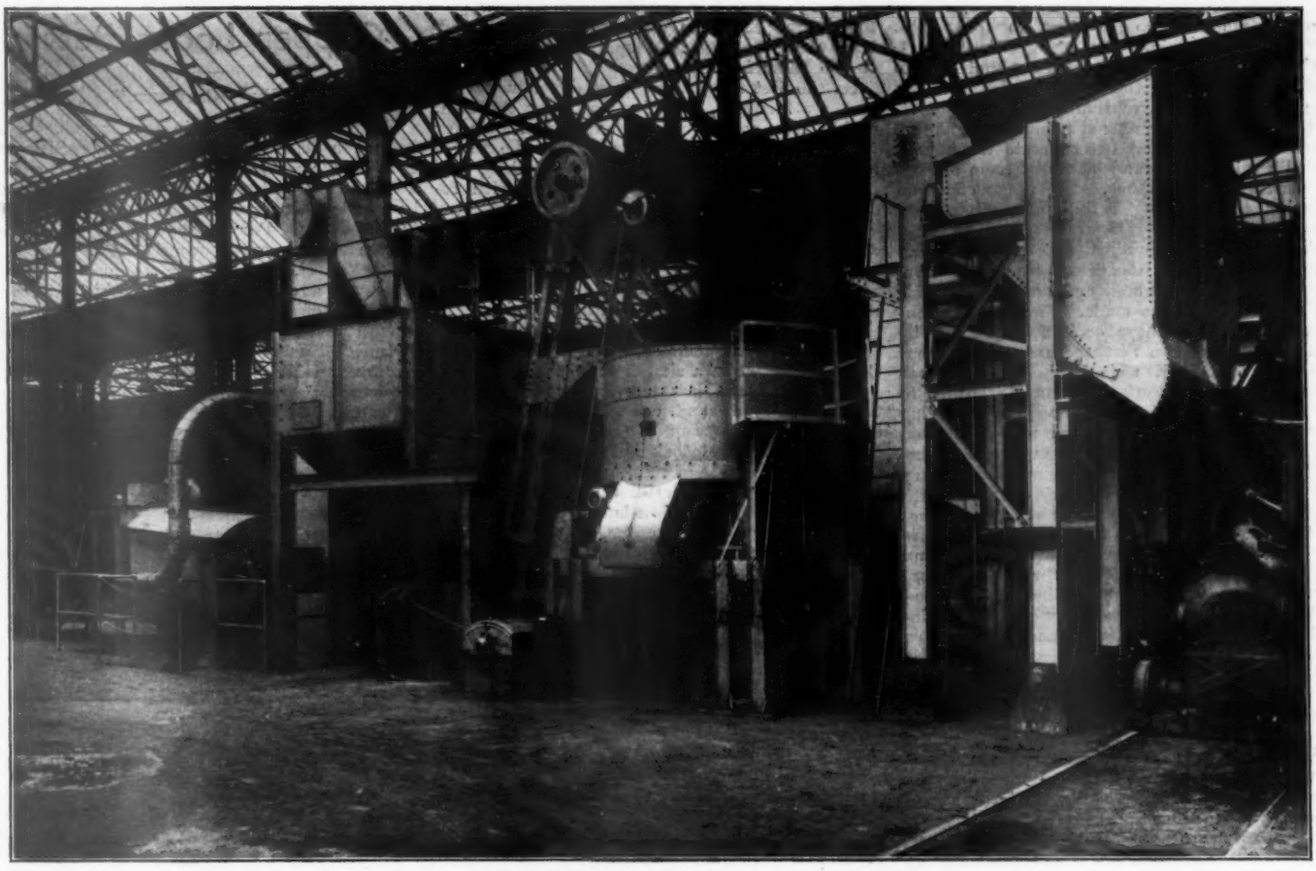

FIG. 9.—SAND-CLEANING AND MIXING PLANT, ARGUS FOUNDRY.

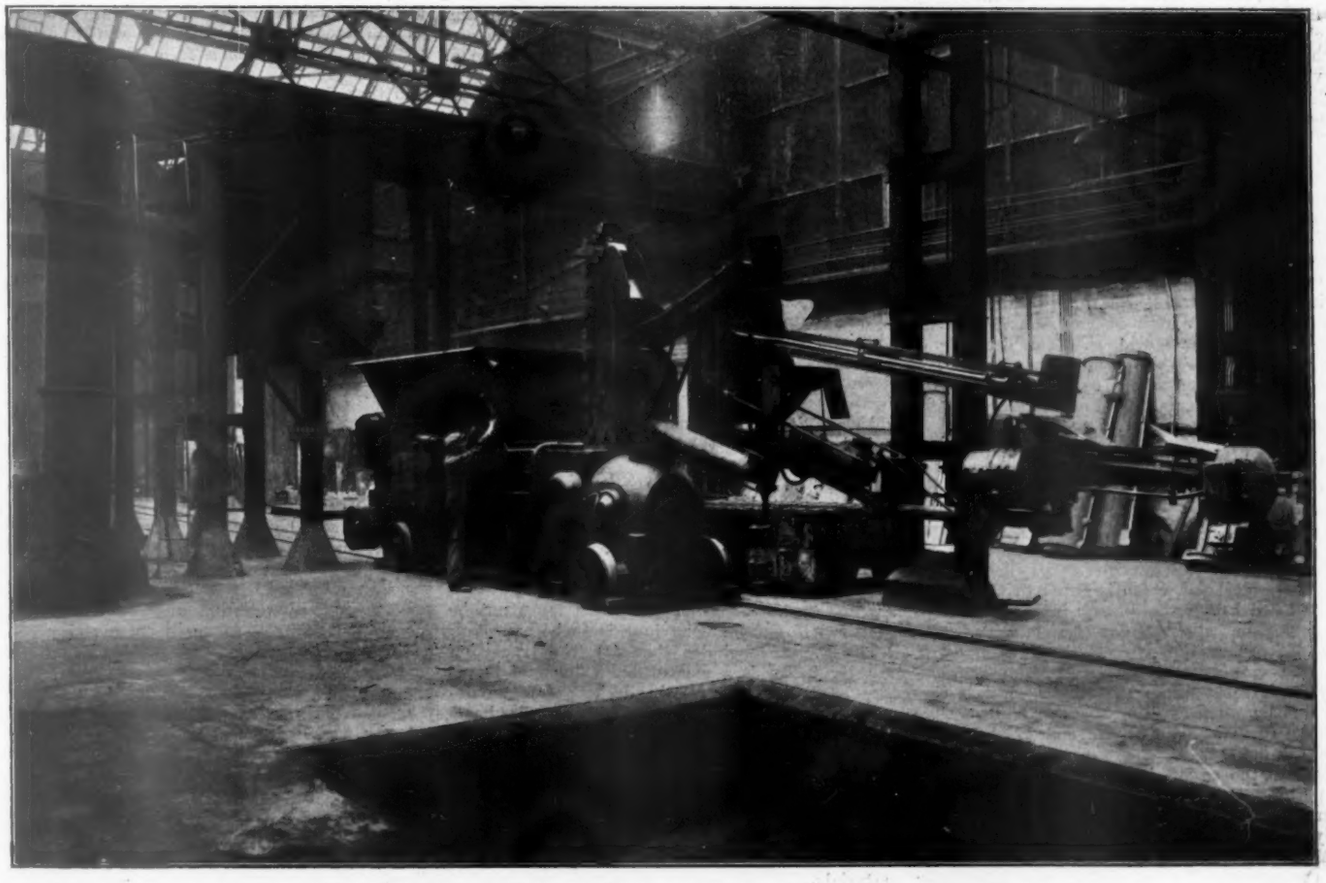

FIG. 10.—VIEW OF SANDSLINGER IN THE FOUNDRY.

machine moulding and casting in iron, gunmetal and aluminium alloys. The building is designed for the maximum of light and cleanliness. The whole of the roof and the sides are of glass, with the exception of the lower 7 ft. of the walls, and all internal steelwork is painted aluminium. The floors are concrete throughout with liberal passages and plenty of room allowed to work and move about. The whole effect on entering the building is one of airiness and broad daylight.

Core-making is a predominant feature in this foundry, the bulk of the cores being made from sea sand with an oil binder. Wherever possible the cores are machine made. The foundry consists of two main bays each 500 ft. long by 55 ft. wide, and two further bays 370 ft. long. The first main bay, which is served by three 5-ton and a 7½-ton overhead cranes, is devoted to the heaviest work; it contains seven drying stoves for the heavy cores and moulds, heated by hot air through the medium of one coke-fired furnace. In this bay there are three heavy jar roll-over moulding machines, dealing with moulds from 30 cwts. to 5 tons and taking boxes up to 7 ft. square. Also housed in the bay are six Morgan tilting furnaces, three of 600 and three of 400 lbs. (coke fired) for melting non-ferrous alloys. The heavy castings are dressed at the extreme end of the bay where are installed two large sand-blast cabins by Tilghmans, these cabins being fitted with a very efficient dust-extracting plant by Spencer & Halstead, which is installed outside the foundry building. In the dressing shop there is also a plant for the extraction of all metal from the refuse.

The second main bay is devoted to the manufacture of cores and the drying of same, the latter being done in a battery of five stoves heated by hot air from a coke-fired furnace. Women workers are employed for making all the lighter cores, the tables and machines at which they work being supplied with sand from overhead bunkers. The cores are loaded on to racks and transported to the ovens by means of lift trucks. The heavier cores are made on machines operated by men and are also supplied with sand from overhead hoppers. Nine machines of varying sizes are utilised in this department for core-making. There are practically no formers used in the foundry for drying the cores, as the core-making is so arranged that all cores are split and the two or more portions then pasted together, a department being set apart especially for this operation.

Further along the bay all the lighter type of work is done by means of six roll-over jar machines having capacities from 2½ cwts. up to 16 cwts., and also 12 Tabor squeeze machines taking boxes from 12½ in. sq. up to 18 in. sq. The sand is dealt with by Simpson & Herbert mixers and Royer machines. The dressing of the lighter castings is carried out at the end of the bay, where ample equipment including grinders, rumblers, saws and one large git cutter for gunmetal is provided.

This bay is served with seven 30-cwt. hand-operated overhead cranes, which are, however, fitted with electric hoist blocks. The metal from the cupolas is transported on a mono rail which traverses along one side of each bay and across one bay. The ladles are transferred, when required, from the rail to the cranes by means of a special double hook which is fitted to the ladles.

The third bay is two storeys in height, except for a portion which houses the cupolas. The ground floor accommodates the storage of cores, and the core-assembly room, previously mentioned. Here the finishing of the cores is carried out by women. The assembly and storage of large cores is done at the end of the heavy moulding bay.

Next to the core-finishing shop is a store for all plate patterns for the squeezer machines. Then come the general stores, foundry office and lastly the power house, in which are housed the Keith Blackman fans for the cupolas and two air compressors for supplying the pneumatic tools. The Tilghman compressor for the sand-blast plant is housed in a separate room adjacent to the plant it serves.

On the first floor, above these departments are lavatory facilities, a dining room for the men, with similar accommodation and a rest room for the female workers. Adjacent to the power house and approximately mid-way along the foundry are two 7-ton cupolas fitted with receivers and one 2-ton cupola.

The cupola-charging platform is served by two electrically-driven hoists, no material is carried on the platform. The charges of one ton are made up immediately behind the cupolas, the stock area having two weighing machines for this purpose, the bogies being elevated to the platform and the cupolas then hand charged. Coke is handled in a similar manner.

The fourth and last bay is devoted entirely to the stocking of sand, coke, pig-iron, etc., with the railway siding running down the inside of the building. The stock is carried in a series of bins. In the case of sand and coke other than foundry coke, the material is transferred from the wagons to the bins by a bucket grab operated from a 5-ton overhead crane. At the end of the bay and alongside the sea-sand storage bin is a 6 ft. Simpson mixer (August's, Limited), which is utilised for the preparation of the core-sand mixtures. From here the sand is transported in barrows to a hoist and elevated to platforms which in turn serve the various bins for the coremakers.

Internal transport in the foundry is by means of petrol-driven tractors, with bogies and tipping trucks. Heating units are arranged at intervals along the sides of all the bays, the heaters being supplied with steam from a Cochrane boiler and deliver hot air at ground level for heating the foundry in the winter time.

A two-storey bay runs along the front of the building and contains the pattern shop and pattern storage with the usual offices, etc.

A walk round the pattern stores indicates forcibly the great variety and high-class work being accomplished by machine moulding in this country and clearly demonstrates that careful consideration has been given to the question of pattern making for this purpose.

Tension Impact Tests

In a Paper on "High-Velocity Tension-Impact Tests" presented to the recent meeting of the American Society for Testing Materials by H. C. Mann, data were given "showing that high-velocity tests are essential to reveal the true dynamic properties of materials." The results obtained further indicate that in the selection of materials for use under conditions involving dynamic loading the following three significant factors must be considered: (1) The transition velocity within which normal material behaviour may be expected. (2) The ratio of total energy value to mass or volume of material involved, and (3) The effect of surface irregularities such as tool marks, size and form of fillets, etc. From an extensive search of the literature pertaining to the subject of impact testing it would appear that this investigation has revealed, for the first time, the fact that materials possess definite transition velocities which must not be exceeded if normal behaviour is to be expected.

The Paper concludes that (*1*) The transition velocity factor is a measurable value and therefore applicable for use in design; (*2*) the development of transition velocity *versus* heat-treatment diagrams should facilitate the selection of the proper materials to meet service conditions involving a known rate of dynamic loading; (*3*) the ordinary type of impact test at only one velocity merely indicates the general effect of specimen geometry of form, and does not reveal the true dynamic properties of materials.

Copper Looks Better

BY "ONLOOKER."

The gradual advance in copper values which has taken place this year has been based on sure foundation: speculation has been almost entirely absent from the market, the upward movement having been instigated in the main by genuine trade buying. For all that, the market would not have seen copper over 9 cents, or even up to that level, had not the producers last year concluded a curtailment pact, which is having the effect of reducing the large reserves above ground which remain as a legacy from the unfortunate policy pursued by the Copper Exporters while they were in power. These stocks are now of much more manageable proportions, and if one considers that a very large tonnage is locked up in the form of blister, which constitutes a normal reservoir for conversion into refined, the total is not so overwhelming. Moreover, there is always a certain amount of "dead" stock which is not in a form suitable for consumption, and remains in warehouses as a backing for metal exchange operations. One way and another the burden of stocks is being lightened considerably, and should soon arrive at a level which would be considered reasonable by everybody concerned.

International Situation

There is, of course, a certain amount of production which lies outside the scope of the curtailment pact, quite apart from the United States, which, since the inception of the 4 cent import duty, has been virtually segregated from the rest of the world. Canada, one of the world's most important copper producers, is not a party to the curtailment plan, but it is understood that there is some working arrangement by which the Canadian output is kept within reasonable bounds. Japan's output is not cut in any way, but since she uses it wholly for her own use, and even imports a certain amount as well, there is no upset to the world statistical position. Russia has a free hand, and output there is creeping up; but the advance is slow, and there is no reason to expect any change of a major nature which would put the Russian production in the forefront of the copper mining districts.

At its present level copper is certainly not dear, and is not high enough to give any marked incentive to production, although there can be little doubt that certain properties are doing quite well. Should events conspire to put the price higher a different state of affairs might be seen, and the present curtailment pact would have great difficulty in holding together.

That point has by no means been reached, for at the time of writing the quotation in America is still at 9½ cents, although rumours are in circulation to the effect that an advance is imminent. After doing very little for three months the American consumers have now begun to buy again, and it looks very much as though this may develop into a buying movement on a big scale, with the inevitable price advance of either 25 or 50 points. London and New York may not be so close together as they used to be, but an upward trend across the Atlantic is still the signal for holders of copper on this side to raise their selling limits, and there are always speculators ready to come in on any sign of an advance. Copper is still a safe investment, actually one of the surest commodity lock-ups available to the investor, and during the present year it will be very strange if the price does not rise to 10 cents or higher.

THE DARWEN IRONWORKS, Lancashire, have been sold by the Darwen & Mostyn Iron Company, Limited, to Thos. W. Ward, Limited, Sheffield, and are being dismantled. The firm's Mostyn works, Flintshire, remain in operation, producing ferro-alloys.

Sand Research

CONFERENCE DISCUSSION AT GLASGOW

Mr. Frank Hudson's Paper on "Composition and its Effect upon the Properties of Mould and Core-Sand Mixtures at Elevated Temperatures,"* presented at the recent Annual Conference of the Institute of British Foundrymen in Scotland, was the subject of a fruitful discussion.

MR. HUDSON, in a few introductory remarks, explained that the practical trial of sands 18 and 19 for the production of steel casting had shown considerable promise. Through the courtesy of Mr. J. Currie and the Carntyne Steel Castings Company, Limited, mixture 18 had been tried out on a small scale and the following report had been received:—

> "The conclusion to be drawn from these tests would seem to be that the sand is suitable for steel moulding, having definitely improved properties over ordinary moulding sand for the prevention of hot cracks or tears, etc., but further work will have to be carried out in order to produce a surface skin satisfactory for commercial practice."

It should be appreciated that sand No. 18 was very open and inclined to be of a coarse grain like "compo," and this did not assist the production of a good casting finish. The protective wash used was silica-molasses. He expressly desired this sand to be tested first in view of its containing a fairly large percentage of organic matter in order to see if any "blowing" occurred. No disturbance of any kind was apparent during the pouring operations, so it was decided to conduct further practical tests with the less permeable sand, No. 19. These tests were carried out through the courtesy of Mr. J. M. Menzies of the North British Steel Company, Limited, and the finish on the castings produced was considerably improved. He had a photograph (Fig. A) of one of the test castings made, a half diesel-engine bearing, after sand blasting only, and it would be agreed that the finish was within commercial practice. In fact, he did not think it would be presumptuous to say that he had seen steel castings produced with a worse finish than this. It might be pointed out that the section of the casting was from 2 to 2½ in., and the protective wash was the normal one used in the foundry referred to. The mould cast perfectly quietly. It might also be of interest to mention that the steel in this latter test was converter steel, whilst the first was from the open-hearth furnace.

It was proposed to conduct further tests in connection with steel casting finishes, particularly taking into account the part played by protective washes as well as the sand employed, but from these few remarks it was evident that the findings in the Paper could be applied to the production of steel castings. In connection with the question of protective washes he would like to make it quite clear that any general remarks he had made in the pre-printed Paper were not intended to apply to the steel-founder. Mr. Hudson, in conclusion, expressed his thanks to the Carntyne Steel Castings Company and the North British Steel Company, for their co-operation.

Saw-dust and Horse Manure

MR. J. J. MCCLELLAND said he would like to compliment Mr. Hudson on his Paper. It appeared to be a very interesting and useful one, but he would like to take some exception to the author's remarks upon the subject of the use of saw-dust. Mr. Hudson had stated that the addition of saw-dust to dry sand had long been a standard practice, but its action had never been fully understood. The speaker could hardly agree with that statement. Whilst there might be some volatile influence from saw-dust, it had nearly always been his experience that saw-dust had not been used for its volatile properties particularly, but more from the permeability point of view. Mr. Hudson had also said horse manure could be used, but, in these days of increased mechanical transport horse manure was getting rather scarce, and he would like to ask if Mr. Hudson had ever known of fine chopped straw or hay being used in localities where horse manure and even saw-dust were unobtainable. He would also like to ask Mr. Hudson if the addition of blacking as a mixture in the sand, in addition to coal-dust, was beneficial in special cases.

MR. HUDSON, in reply, thanked Mr. McClelland for his remarks. He agreed that saw-dust had a very definite action in regard to permeability but he did not mention that fact in view of the title of the Paper. The effect of saw-dust on permeability, according to Mr. McClelland's argument, might not apply at high temperature. He had also heard of chopped straw and hay being used, but that of course was similar, in his mind, to saw-dust or manure. He did not think the passage of time would cause us to be bothered by the absence of horse manure, because one might use, for instance, old rubber tyres in certain applications. In regard to blacking, he had seen many mixtures used embodying a certain amount of blacking in conjunction with coal-dust, and he thought it had definitely beneficial effects for castings of certain types, but for the average engineering founder he failed to see its full advantage. For ornamental work, it probably had a great advantage, and even for very heavy castings in as much as the presence of the blacking definitely prevented fusion of the sand and increased its refractory property. His own opinion, however, was that it was not necessary in a properly balanced sand mixture.

FIG. A.

Experimental Methods Queried

MR. A. SUTCLIFFE (Bolton) said, in reference to Figs. 9 and 11, that he thought it would be impossible to make such castings. A moulder receiving a job similar to Fig. 10 would imagine the foreman had "gone mad." He asked whether the core for this casting had been vented from the bottom, since this only was necessary as it was a dry sand core. He suggested that the runner was too small and had burnt the core where the surface was shown to be rough. He inquired whether the risers were "closed" or "open" during casting. He queried the desirability of having one runner only of ⅝ in. diameter and two ¾ in. uncovered risers, wrongly situated. The job, he said, could have been cast green with a different system of running and the practical man attributed the cause of such defects as were experienced to poor running conditions. Referring to coal-dust in sand, he expressed the opinion that the whole question was best left to the practical foreman, and that the tendency was towards obsolescence in company with such things as road sand, stale beer and horse manure. For castings up to 1 ton in weight they could be moulded in green sand containing no coal-dust and they could be cast the same day. The resulting castings would be greyer than usual, but personally he preferred that type of finish to a mirror one as denoting improved internal soundness. Mr. Sutcliffe suggested that such castings as tank plates twelve feet long by six feet wide having a ⅝ in. thickness of metal and gutters up to twenty foot long, two inches wide and eight to ten inches deep carrying a half-inch section of metal, moulded in green sand and cast the same day constituted the best test for sand. Finally, he asked if camel hair brushes did not rapidly deteriorate when used with oil in wet blacking.

MR. HUDSON, in replying, said in regard to Fig. 10 that he was sorry that Mr. Sutcliffe had not had an opportunity of making these castings, because then he might not have been so keen on saying that he did not know how the defects were produced. Mr. Hudson admitted he had picked the worst examples he could find to illustrate the Paper.

Too Many Variables

MR. ROBERT BALLANTINE (Fullwood Foundry Company, Limited) said Mr. Hudson was to be congratulated once more on his very fine work on sands. He had the feeling, however, that Mr. Hudson was moving somewhat rapidly in his deductions, and consequently he would rather see what he might describe as established fundamentals in sand practice before elaborating on the results of innumerable tests. He thought the definition "floor sand" was not convincing, and when one bore in mind that, in various mixtures, close on 70 per cent. was used, one naturally asked what the composition was. Another point was that he could not feel too happy on this juggling with the moisture content. The range, from traces to 18.4 per cent., did not impress him. If convincing data were their aim, then they could only build from a sure foundation by eliminating the variables one at a time. He readily agreed that the subject of the Paper caused some concern, but at the same time the problem was not a major one in the production of good castings.

Ingot Mould Practice

He was sorry that Mr. Hudson had thought fit to include coal-dust, saw-dust, horse manure, etc., in tests, because it appeared to him that this was a retrograde step. For some considerable period he had observed the results in the production of thousands of tons of flawless ingot mould castings, ranging from 2 to 40 tons in weight, all made in dry sand. The metal thickness ranged from 3 inches to 16 inches, and there were many designs. The core sand was strictly controlled in a modern plant, good-quality Scottish rotten-rock sand was the basis, and a ratio of five reclaimed core sand to one of new was used. The fines were removed, the milling time was five minutes, and moisture content was controlled at 6 per cent. Nothing else was added except ashes in the centre. Internal core barrels were neither used, nor was sprigging allowed, and only a minimum of horizontal gratings of very light section was included. Two types of cores might be quoted, namely: (1) a duodecagonal fluted core, standing 11 ft. 6 in. high, top heavy at 3 ft. 2 in. diameter tapering to 2 ft. 9 in. at the bottom;

* FOUNDRY TRADE JOURNAL, June 11, p. 458 and June 25, p. 502.

the approximate weight of sand in the green state was 3 tons 5 cwts. and this had to stand up to a 26-ton casting; (2) a rectangular core 9 ft. high, top heavy at 5 ft. 6 in. by 3 ft. 6 in. as against a bottom size of 5 ft. 5 in. by 2 ft. 10 ins.; the sand weight in the green state was 3 tons 15 cwts. and produced a 34-ton casting. In finishing, the blackwash was liberally applied, fully one-sixteenth of an inch. Thick clay was dried and mechanically pulverised, and then added in powdered form to the mixture. By these methods consistency was assured, and scabbing of the cores was practically unknown. Mr. Hudson had assured them in reference to Fig. 10 that there was no question whatever about the cores being dried, but had he considered the effect of overdrying on moulds and cores? The example in this instance was unquestionably one of proper gating. The sand question was all important, but his feeling was that they should move forward on something definite and not too involved. In conclusion, Mr. Ballantine felt that the branches should have an opportunity for further discussion on this Paper from a practical viewpoint, as in his opinion other factors must be considered.

MR. HUDSON, after thanking Mr. Ballantine for his remarks, said, to his mind, with due respect to Mr. Ballantine, ingot moulds were not a big question so far as casting production was concerned. When articles such as high-pressure castings, automobile castings, etc., were studied, the manufacture of ingot moulds was simple compared with some of these. He suggested that there was one fault in Mr. Ballantine's reasoning since all these factors were dependent on the human element, and perfection would never be attained as long as that very variable factor was present.

Nebulous Criticism Criticised

MR. BEN HIRD said he thought the practical moulder should not be too hypercritical about a Paper he did not fully understand. It was of no use reading a Paper and then declaring "I never did this." Surely if one wanted to disprove a man's experiments, one ought to try them out, following his instructions, and then if they proved wrong, contradict him; but one should not contradict a new experiment simply because one thought it could not be applied to any particular job.

Control of Thermal Conductivity

MR. ADAM DUNLOP (Kilmarnock) desired to know whether Mr. Hudson could suggest any modification to moulding material mixtures enabling the thermal conductivity to be controlled as it would be very useful to have this property under control. For example, the physical properties of gunmetal could be greatly enhanced by chill casting. It was not possible to chill-cast every job; therefore it would be advantageous if the thermal conductivity of the moulding sand could be increased. On the other hand, however, by reducing the thermal conductivity of the sand the casting of thin sections would be made easier.

MR. HUDSON indicated that he would require time to consider that question.

MR. J. H. COOPER said he was deeply interested in the Paper, so much so that he was reluctantly compelled to say that he thought it was unfair both to the author of the Paper, and members present, to limit the time for discussing the Paper and in replying to the discussion.

MR. C. H. KAIN asked Mr. Hudson what method he employed for crushing his fire bricks. Could he give any indication of the degree of fineness to which he ground it?

MR. HUDSON replied that the bricks were crushed in a heavy pan mill. At first all material that passed an 80 mesh sieve was rejected. The first castings made in the steel foundry were made from that sand, and the finish was very bad. In the case of the second castings, they removed no fines, and the castings were fairly satisfactory.

Origin of Horse Manure Additions to Sand

MR. J. E. HURST (Past-President) proposed a vote of thanks to Mr. Hudson for his Paper. Regarding the reference to horse manure, he remarked that he once spent some time in endeavouring to find out who the first man was to use horse manure in moulding sand, and it was rather interesting, because the first record of making moulding sand in the commonly accepted manner amongst foundrymen of a few years ago, that is, from natural sands and horse manure, was due to Isaac Wilkinson, the father of John Wilkinson of cupola fame. In the Patent Journals they would find there a Patent, dated about the year 1750, which was the first written record of the use of moulding sands of the type that were in use to-day.

The vote of thanks was heartily accorded, and MR. HUDSON replied.

Corrosion and Protection of Pipe Lines

At the Chemical Engineering Congress of the World Power Conference, held in London recently, C. A. H. VON WOLZOGEN KÜHR and J. PH. PFEIFFER (Holland) read a Paper on "Corrosion and Protection of Cast-Iron and Steel Pipe-Lines in the Soil." We append the authors' summary.

Besides the aerobic corrosion of iron, the very frequently encountered anaerobic corrosion of iron has been studied in the Netherlands since 1922. The study of the latter process has yielded the following results:—Like iron rust in aerobic corrosion, the iron sulphide found in anaerobic corrosion may be termed a product of corrosion. For the progress of the primary process of iron corrosion:

$$Fe + 2H\cdot \rightarrow Fe^{\cdot\cdot} + 2H$$

a depolariser is necessary. It has been found that in the cases of anaerobic corrosion examined, this function has generally been fulfilled by the sulphate oxygen as hydrogen acceptor in sulphate reduction, a microbiological process. According to Baars, the reaction can be represented as follows:—

$$H_2SO_4 + 8H \rightarrow H_2S + 4H_2O.$$

Consequently, the anaerobic corrosion of iron with sulphate reduction may be regarded as an electro-biochemical process, the course of which may be represented by the reaction:

$$4Fe + H_2SO_4 + 2H_2O \rightarrow 3Fe(OH)_2 + FeS,$$

which accounts for observations made in laboratory experiments and the facts of anaerobic corrosion in practice. With alternate anaeroby and aeroby in the soil, the anaerobically-formed iron sulphide in iron corrosion will be converted to acid ferric sulphate. As a result, in the absence of an excess of carbonate of lime in the soil, the corrosion of iron will be more pronounced than before.

From an electrochemical point of view there is no essential difference between the processes of corrosion of iron pipe-lines in the ground, as they all originate in the anodic solution of iron with the aid of a depolariser. It is always possible to explain similarities and differences in corrosion by the prevailing conditions under which the iron corrodes.

The study made of anaerobic corrosion of iron has revealed the serious effect which contact between the iron pipes and the soil may have upon corrosion. It was accordingly concluded that the protective coating applied to iron pipes must meet the following requirements:—(*a*) The protective agent must be proof against aggressive soil influences; (*b*) the coating applied to the surface of the iron piping must be waterproof; (*c*) the protective material must be able to withstand rough treatment in transit and during the laying of the pipe-line.

Since at present it is difficult to meet the last-named requirement, it is essential, to avoid damaging the pipe insulation, that care should be exercised in conveying and laying the pipes.

The problem of finding an entirely satisfactory coating, both from a technical and an economical point of view, can ultimately only be solved by making practical trials on actual pipe-lines. The results of practical trials can only usefully serve this purpose if the causes responsible for failures are known. Laboratory experiments, in which every factor which may give rise to failure is taken into account, may be used as a guide in the choice of the coatings to be applied and, once the relation is seen between these experiments and those made on the pipe-lines, these laboratory experiments may be utilised as methods of test. To this end, Corrosion Committee II of the "Stichting voor Materiaalonderzoek" (Institution for the Testing of Materials), of The Hague, Holland, has made a number of experiments on bituminous coatings.

A classification of asphaltic bitumens, based on the relation between the penetration figure at 25 deg. C. and the ring and ball softening-point, simplifies the characterisation of these materials. Six groups of requirements for the coatings are stated, in accordance with which the various tests are arranged:—(1) Most bituminous coatings meet the requirement that the coating shall not alter or age during the desired life of the pipe-line. (2) The impermeability of the coating can be tested by several methods, which are discussed in brief. These tests show that only coatings at least 0.35 mm. thick are sufficiently impermeable. (3) Good adhesion can be obtained both with coal-tar pitches and asphaltic bitumen. Removal of mill scale is considered advisable. The choice of a proper primer is important. (4) The testing of the non-flowing properties by two methods is described. (5) The resistance to ground pressure has been studied; laboratory tests are being developed. (6) Resistance to shocks and distortion is, as far as the bitumens are concerned, mainly a question of brittleness. The Fraass method is used for thin coatings of pure bitumen; for heavy filled coatings a kind of shatter test has been devised.

Judging from the results of the tests of bituminous compositions, blown asphaltic bitumens are to be preferred to coal-tar pitches. This is supported by recent developments in pipe protection in Britain and on the Continent. For coal-tar pitches certain advantages over the blown bitumens, viz., lower working temperature, better adhesion to the metal and less tendency to absorb moisture, are claimed. On scrutinising these claims, the latter two are not found to give the coal-tar pitch any substantial advantage over well-manufactured and well-applied asphaltic bitumens.

The fillers for the coatings have to be chosen carefully, as many of them do materially increase the water absorption. Apart from bituminous kraft paper, which may be used as a cheap and rather effective temporary shield, reinforcements of impregnated fabrics or felts are preferred to shields.

In the choice of the most suitable kind of protection in a certain case the following factors have to be considered: (*a*) Contemplated life of pipe-line; (*b*) probable aggressiveness of the soil; (*c*) material of the pipe (steel or cast iron); (*d*) place of application of coating. It is on these data, combined with economic considerations, that the choice of the type of protection—either dip-coating or enamel or reinforced coating—must be based. The most suitable material can be chosen on the strength of laboratory tests.

When the pipe-lines are coated in the field, filled enamels of coal-tar and "Z"-type asphaltic bitumens are frequently used side by side with those made with blown asphaltic bitumens, although the latter may prove to have advantages when applied properly. Blown asphaltic bitumens are decidedly preferred for the manufacture of mill-coated pipes.

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The Week's News in Brief

Trade Talk

STEWARTS AND LLOYDS, LIMITED, have received an order from the Central Argentine Railway for 2,900 acid-resisting steel tubes.

HENRY HOLLINGDRAKE & SON, LIMITED, of Stockport, entertained their staff to a two-day trip to London and Windsor last week.

HENRY WIGGIN & COMPANY, LIMITED, nickel and nickel-alloy manufacturers, are to extend their Zenith Works at Thornliebank, Glasgow.

THE TELEPHONE NUMBER of Miss C. Elliott, honorary secretary of The Institute of Vitreous Enamellers, has been changed to Renown 2896.

GLENFIELD & KENNEDY, LIMITED, Kilmarnock, are to supply 220 cast-iron sluice valves for the Birmingham, Tame and Rea District Drainage Board.

FERGUSON BROS. (PORT GLASGOW), LIMITED, have launched the second of two wreck-raising vessels which they are building for the Port of London Authority.

THE CONSETT IRON COMPANY, LIMITED, have blown-in their No. 8 furnace, which had been out of commission for a considerable period. The furnace has been reconditioned.

THE EMPLOYEES OF R. & A. Main, Limited, Falkirk, held their annual sports meeting in Carmuirs Park. Mrs. A. Cockburn presented the prizes to the successful competitors.

IN HIS ADDRESS to the shareholders of Richard Thomas & Company, Limited, Sir William Firth stated that the company had three foundries, with an annual capacity for making 30,000 tons of castings.

DORMAN, LONG & COMPANY, LIMITED, have secured a contract to supply and erect 4,170 tons of steel, valued at $1,500,000 (Chinese), on a new bridge to be built across the Chian Tang River at Hangchow. The total contract value is $4,500,000.

A NEW PLANT for the manufacture of ferro-silicon has been erected at Beauharnois, Quebec, by St. Lawrence Alloys, Limited, deliveries of which will commence early in August. Other alloys are to be produced at later dates. T. Rowlands & Company, Limited, 23-27, Broomhall Street, Sheffield, represent the company in Great Britain.

THE IMPORT DUTIES ADVISORY COMMITTEE give notice of an application for an increase in the import duty on metal split pulleys and parts, including bushings. Any representations which interested parties may desire to make in regard to the application should be addressed to the Secretary, Import Duties Advisory Committee, Caxton House, Tothill Street, Westminster, S.W.1, not later than August 20.

THE BELGIAN USINES MÉTALLURGIQUES DU HAINAUT report a net profit of 9,480,000 fcs. in 1934, as against 166,000 fcs. in 1934. The capital of the company is 91,330,000 fcs. Trade has shown a marked improvement, which continued into this year.

G. A. HARVEY & COMPANY (LONDON), LIMITED, are extending their Greenwich Metal Works, and a new building having a floor space of more than 100,000 sq. ft. is now nearing completion. This extension comprises three bays each 800 ft. by 50 ft. wide and 43 ft. high.

WITH A VIEW to enlarging the scope of the respective businesses, a merger of interests has been concluded between Broom & Wade, Limited, of High Wycombe, and B.E.N. Patents, Limited, of Park Royal, London. Broom & Wade, Limited, manufacture portable and stationary air compressors and pneumatic tools, while the products of B.E.N. Patents, Limited, include a range of small air compressors and other equipment.

PARLIAMENT HAS SANCTIONED the advance of monies for the construction of a sister ship to the "Queen Mary." It is to be built by John Brown & Company, and until the launch will be known as the "552." The reaction on the foundry industry will be considerable. If the keel is laid down during next month then the launch will be towards the end of 1937, and the ship will be ready for the Atlantic service in the summer of 1939.

THE CANADIAN NATIONAL EXHIBITION, to be held in Toronto from August 28 to September 12 next, will include a British section, in which the Department of Overseas Trade are to install an Information Bureau. The Section is organised by the British Trade Section of the Toronto Board of Trade, in co-operation with the exhibition management. The British Government will again be represented through H.M. Trade Commissioner in Toronto.

THE SKODAWERKE report a net profit of 41,720,000 Cr. in 1935, as against 22,310,000 Cr. in 1934, including 2,060,000 and 11,070,000 Cr., respectively, brought in, and after writing off 68,790,000 and 43,260,000 Cr. respectively. Deducting the balances brought in, the trading profit after depreciation was thus 39,660,000 Cr. in 1935, against 11,240,000 Cr. in 1934. The share capital of the concern is 200,000,000 Cr., and the reserves total 646,720,000 Cr. (Current exchange: 120 Cr. = £1.)

THE FORMATION of the Lead Industries Development Council is announced. This marks a further stage in the progressive co-operation between manufacturers of lead products, such as white lead, red lead, sheet lead and lead pipes, and the lead-mining and smelting organisations operating within the Empire. The principal functions of the Council will be to give authoritative information and to promote new and improved methods of using lead and its products, and it will absorb and co-ordinate the separate organisations hitherto maintained in the United Kingdom for similar purposes. The Council is sponsored by the whole of the lead-products-manufacturing industry, as well as by the Empire lead-mining and smelting companies. The chairman is Mr. H. S. Tasker (managing director, Associated Lead Manufacturers, Limited). Mr. Roger Hodgson has been appointed secretary. The address of the Council will be Rex House, 38, King William Street, London, E.C.4.

Institute of British Foundrymen

SOUTH AFRICAN BRANCH?

"There is little doubt," says the second issue of "Engineer and Foundryman" [South Africa], "that the Transvaal Engineering Federation will shortly call the foundrymen together for the purpose of organising a South African Branch of the Institute [of British Foundrymen], as soon as it has accomplished some of its more pressing business, and in the meantime, foundrymen who are interested in the project are invited to communicate with us."

This is the concluding paragraph of a page article devoted to the work of the Institute. We are aware that Mr. A. H. Moore, the corresponding member of the Council of the Institute for South Africa, has for many years been carrying on much quiet propaganda amongst his colleagues in the foundry industry. Mr. A. H. Guy is also an enthusiastic supporter of the scheme.

Company Reports

Mather & Platt, Limited.—Interim dividend on the ordinary stock of 4 per cent.

Vickers, Limited.—Interim dividends for the half-year ended June 30, 1936, on the preferred 5 per cent. stock, the 5 per cent. preference stock, and the cumulative preference stock.

Consett Iron Company, Limited.—Profit, £519,626; bad debts, £2,735; directors' fees, £4,638; debenture interest, £112,500; net balance, £399,753; brought in, £56,735; to reserves, £150,000; to improvements reserve, £200,000; carried forward, £106,488. Meeting, August 11.

W. & T. Avery, Limited.—Net profit, £149,601; brought in, £60,483; dividends for the year on the 5 per cent. "A" preference shares, £5,243; dividends on the 5½ per cent. "B" preference shares, £6,322; interim dividend of 5 per cent. on the ordinary shares, £33,099; further dividend of 10 per cent., making 15 per cent. for the year, £65,665; to general reserve, £37,363; carried forward, £62,392.

Personal

MR. V. C. FAULKNER informs us that his correct postal address is 70, Carlton Avenue, Harrow.

MR. B. E. STOTT, general manager of Ferrous Light Castings, Limited, Warrington, has been elected to a seat on the board of that company.

MR. A. W. SWAN, sales promotion and publicity manager of the United Steel Companies, Limited, has been elected chairman of the Sheffield Publicity Club for 1936-37.

MR. ANDREW STARK, who has been 55 years in the service of the Lion Foundry Company, Limited, Kirkintilloch, has received gifts from directors, staff and fellow-workmen on the occasion of his retirement.

MR. CLARENCE D. SMITH has resigned from the position of chairman of the Consett Iron Company, Limited, but remains a member of the board. MR. CLIVE COOKSON has been appointed in his place. MR. EDWARD J. GEORGE has been appointed deputy-chairman.

TO CELEBRATE the 77th birthday of their secretary, Mr. George Hodgkinson, members of the Openshaw Branch of the United Patternmakers' Association have subscribed to present him with a cheque for £60. Among those who paid tribute to him as a trade-union pioneer and a model branch secretary were Mr. Ellis Smith, M.P., Mr. A. H. Findley, President of the T.U.C., and Mr. W. Mosses, former general secretary of the Patternmakers' Association.

Wills

SANDS, JOHN, of Hall Green, Birmingham, ironfounder	£18,577
HOBBS, C. J., of Colchester, formerly manager of the Hydraulic Engineering Company, Limited, Chester ...	£12,927

Obituary

MR. FREDERICK AUBREY NORRIS, chairman and founder of the firm of F. A. Norris & Company, Limited, structural engineers and ironfounders, London, has died at the age of 63.

Contracts Open

Ipswich, August 3.—250 yds. of 12-in. cast-iron pipes, for the Town Council. Mr. E. McLauchlan, borough engineer, Town Hall.

Johannesburg, August 31.—Coal-pulverising unit, with all equipment for firing two furnaces, for the South African Railways and Harbours Administration. The Department of Overseas Trade. (Reference T. 30,464.)

Saffron Walden, August 24.—Pumping machinery, for the Rural District Council. Sands & Walker, consulting engineers, Milton Chambers, Nottingham. (Fee £2 2s., returnable.)

Saltash, August 20.—Providing, laying and jointing about 9¾ miles of 12-in. dia. spun-iron main, and other works, for the South-East Cornwall Water Board. Lemon & Blizard, engineers, 24, Lockyer Street, Plymouth.

B.S. Specifications for Alloy Steels

B.S.S. No. 681—1936: Carbon-Chromium Steel, and B.S.S. No. 682—1936: 3 per cent. Nickel-Chromium Case-Hardening Steel have just been issued by the British Standards Institution as the result of a request for steels of these types from the Committee engaged in the preparation of the British Standard Specifications for Gears. The Specifications are intended for the purchase of bars and billets for forging and bars for machining, and the heat-treatments and mechanical properties are based on 1½-in. dia. test samples. Attention is called to the fact that it must not be inferred that similar treatment will be used for, or the same mechanical properties required of, parts made from these steels. Copies of these specifications (B.S.S. Nos. 681—1936 and 682—1936) may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1. (Price 2s. 2d. each post free.)

THE "ROCKET" CORE MAKING MACHINES

HELP to . . .

REDUCE COSTS AND MAKE SOUND CASTINGS

for

BRITISH

— STEEL FOUNDERS —
GREY IRON FOUNDERS
MALLEABLE FOUNDERS
NON-FERROUS FOUNDERS

used in the manufacture of—

Electric Cookers. Gas Cookers. Motor Transport Vehicles. Aeroplanes. Internal Combustion Engines. Cast Iron Bath Fittings. Brass Water Service Fittings. Sluice Valves. Gas Valves. Rain Water Castings. Textile Machinery. Lawn Mowers. Ship Building, etc., and General Engineering Castings.

FOUNDRY ENGINEERS LIMITED

HALIFAX — YORKS.

Telephone: Halifax 61459. Telegrams: "FEL," Halifax.

Raw Material Markets

Conditions in the iron and steel markets remain quiet, and although consumption and production are on a heavy scale, new buying only involves small tonnages. However, as soon as the holiday period is passed producing works are expected to receive orders amounting to quantities at least as large as has been the case in recent months. The full outputs, which are at record levels, are being immediately taken up under existing contracts and the lull in new business is giving makers a welcome opportunity to make headway in overcoming their arrears in deliveries. Steelworks remain very active, all departments being well employed.

Pig-Iron

MIDDLESBROUGH.—Activity in the Cleveland pig-iron market is chiefly concerned with the despatch of deliveries under existing contracts and little iron is available for new inquiries. Consumers' requirements are being satisfied without much difficulty, but delivery arrears are still considerable. Most users are well covered for supplies over several months, and they are content to remain out of the market so long as they are able to obtain adequate supplies for their immediate needs. The price of No. 3 Cleveland G.M.B. is 75s. for delivery in the Middlesbrough or Falkirk areas, 77s. on the North-East Coast and 78s. on Clydeside.

The output of hematite on the East Coast is drawn from 11 blast furnaces, but, even so, there is no surplus material after home requirements have been met. There has been a renewal of shipments to South Wales and the inquiry from abroad is fair, in spite of the higher quotation compared with Continental material. Mixed numbers are quoted at 85s. and No. 1 quality 85s. 6d. per ton delivered to Scottish and North-East Coast buyers, a rebate of 5s. per ton being allowed to users who do not place orders in other areas. Hematite is quoted on export account at around 75s. per ton f.o.b.

LANCASHIRE.—New business does not amount to any substantial tonnage, but consumers are demanding heavy deliveries from the Midland furnaces. Machine-tool makers and heavy electrical engineers are busy, as also are the general engineers and the light-castings manufacturers. There has been a slight improvement in the condition of the textile machinists, but this section of the industry remains unsatisfactorily employed. For delivery to users in the Lancashire price zone, offers of Staffordshire, Derbyshire and Lancashire brands of No. 3 iron equal to Derbyshire are all on the basis of 83s. per ton, with Northants at 81s. 6d. and Derbyshire forge at from 78s. to 80s., according to the class of user. Scottish No. 3 foundry is quoted at around 90s. for delivery in the Manchester district. West Coast hematite is at 93s. 6d. and East Coast 93s., less a rebate of 5s. per ton.

MIDLANDS.—Deliveries from the furnaces to local ironfounders continue to be made on a good scale, although it is believed that the demand during the current month has been rather less than that of June. Stocks are very low and unless a substantial increase in production is made a shortage is bound to result in the autumn if the call for supplies does not abate. For delivery to Birmingham and Black Country stations the current Association prices for ordinary Midland brands of iron are 77s. 6d. for Northants No. 3 and 80s. for Derbyshire, Lincolnshire and North Staffordshire No. 3, less a small sliding-scale rebate to large users. The price of forge pig-iron is 5s. per ton below that of No. 3 foundry. A good demand exists for irons of special quality. Medium-phosphorus irons are on offer between 82s. 6d. and 90s., low-phosphorus 92s. 6d. to 100s., with Scottish at about 95s., and refined quality is quoted between £6 10s. and £7 15s., delivered South Staffordshire. Deliveries of hematite are still in arrears and there is a shortage of some classes. It is impossible to transact new business at current prices beyond the end of December and, owing to their having sold their full output over this period, many makers are refusing to enter into any new commitments. The controlled prices for delivery in this area and subject to 5s. rebate, are £4 17s. for West Coast mixed numbers, £4 16s. for East Coast No. 3, and £4 15s. 6d. for Welsh mixed numbers, with 1s. 6d. extra if delivered into works in 10-ton lots.

SCOTLAND.—There has been little activity in this market during the past week owing to there having been a slow resumption following the Fair holidays. Prices remain unchanged at 79s. f.o.t. furnaces for No. 3 foundry, and 2s. 6d. per ton extra for No. 1. Good order-books are reported by the light-castings makers, who are very active. No. 3 Cleveland iron is still quoted at 75s. f.o.b. Falkirk and 78s. f.o.t. Glasgow. The prices of steelmaking irons are unchanged, mixed numbers East Coast, West Coast and Scottish hematite being quoted at 85s. 6d., less 5s. rebate; basic, British and Indian, 75s., less 5s. rebate, delivered steelworks.

Coke

There is little change in the condition of the foundry-coke market, which is very firm. For delivery in Birmingham and district, best Durham foundry coke is quoted at between 41s. 6d. and 43s., and Welsh from 39s. 6d. to 50s., according to quality.

Steel

Conditions in the steel market have become rather quieter, but there has been no relaxation in the activity at the steelworks, says the official report of the London Iron and Steel Exchange. Consumers' requirements are well maintained, and although production is almost at a record rate, deliveries in several departments of the industry are in arrears. The request for semi-finished steel has been active, but the home works are so heavily committed that it has not been easy to place orders for near delivery. The producing works are operating practically at capacity, but are finding it difficult to meet the full requirements of the market. The position in this department, however, seems to be slowly improving, and holiday stoppages have enabled the makers to overtake some of the delays in the execution of orders. In the finished-steel section there is a tendency for new business to become quieter, but the pressure on deliveries seems to increase. Large quantities of structural steel are passing into consumption, and users are finding it difficult to obtain the material they need. Inquiry on export account has broadened somewhat of late, but buying by oversea markets fluctuates.

Scrap

Imports of foreign scrap are being made on a heavy scale in the Cleveland area and until these have been fully absorbed there is sure to be a restriction of deliveries of home supplies. Good heavy melting steel remains at 57s. 6d. per ton, delivered at consumers' works in this area, while there is an active demand for machinery metal at 67s. 6d. Heavy foundry cast iron is at 65s. The demand for most qualities in the Midland market is steady, but prices are easy owing to the abundance of supplies. Heavy steel in furnace sizes is at 52s. 6d. and mixed iron and steel at 50s. to 51s. 6d. Short, heavy steel scrap, as used in the foundries, is at 65s. to 67s. 6d. Heavy machinery in handy sizes is at 70s., good heavy at 65s. and clean light at 52s. 6d. to 55s. per ton delivered works. The Fair holidays of last week have prevented much activity on the Scottish market and prices are without alteration. Heavy mild-steel scrap is at 57s. 6d., with basic at 52s. 6d. Heavy machinery metal, in pieces not exceeding 1 cwt., is at 68s. 6d. to 70s., with ordinary cast iron, to the same specification, at 63s. per ton, delivered consumers' works.

Metals

Copper.—There has been a good tone on the London market and buying has involved quite a substantial tonnage. In the United States consuming industries are well employed, the motor car trade being a particularly heavy user of copper. Domestic consumption has been on a good scale, while the demand from abroad, especially Japan, has been heavy, most of the copper being required for armaments purposes.

Daily market prices :—

Cash.—Thursday, £37 13s. 9d. to £37 16s. 3d.; Friday, £37 13s. 9d. to £37 15s.; Monday, £37 16s. 3d. to £37 17s. 6d.; Tuesday, £37 18s. 9d. to £38; Wednesday, £37 18s. 9d. to £38.

Three Months.—Thursday, £38 to £38 1s. 3d.; Friday, £37 18s. 9d. to £38; Monday, £38 1s. 3d. to £38 2s. 6d.; Tuesday, £38 5s. to £38 6s. 3d.; Wednesday, £38 5s. to £38 6s. 3d.

Tin.—The general appearance of this market remains somewhat uncertain and buyers have adopted a cautious attitude. Consumption is reported to have been well maintained. Buying in this country has been quiet during the past week and similar conditions are reported from the United States. According to the July issue of the International Tin Research and Development Council's bulletin, published by the Hague Statistical Office, world apparent consumption of tin in May was 1,400 tons lower than in April, and was also lower than the figure for May of last year by about 2,000 tons. The experts of the International Tin Committee, who have been discussing with the Siamese authorities the request for an increase in Siam's tin quota, left Bangkok by air on Sunday. No statement was made by the experts.

Metal Exchange quotations were as follow :—

Cash.—Thursday, £189 15s. to £190 10s.; Friday, £188 15s. to £189; Monday, £185 to £185 10s.; Tuesday, £179 10s. to £179 15s.; Wednesday, £184 to £184 10s.

Three Months.—Thursday, £186 15s. to £187; Friday, £185 10s. to £185 15s.; Monday, £182 to £182 5s.; Tuesday, £176 5s. to £176 10s.; Wednesday, £180 15s. to £181.

Spelter.—The recently improved position of this metal has been maintained and the turnover has increased during the week. It is thought possible that a meeting of interested producers may take place in August in connection with the re-establishment of the International Zinc Cartel, but, as yet, the position remains very uncertain.

Official quotations were as follow :—

Ordinary. — Thursday, £13 15s.; Friday, £13 13s. 9d.; Monday, £13 15s.; Tuesday, £14; Wednesday, £14 1s. 3d.

Lead.—Satisfactory conditions have prevailed on this market and buying has involved a substantial tonnage. A large quantity has been bought in this country by Russia, who, hitherto, had shown little interest for some time. Activity among pipe and sheet makers is on a good scale and large tonnages of lead are consumed through these sources. The building industry remains very well employed.

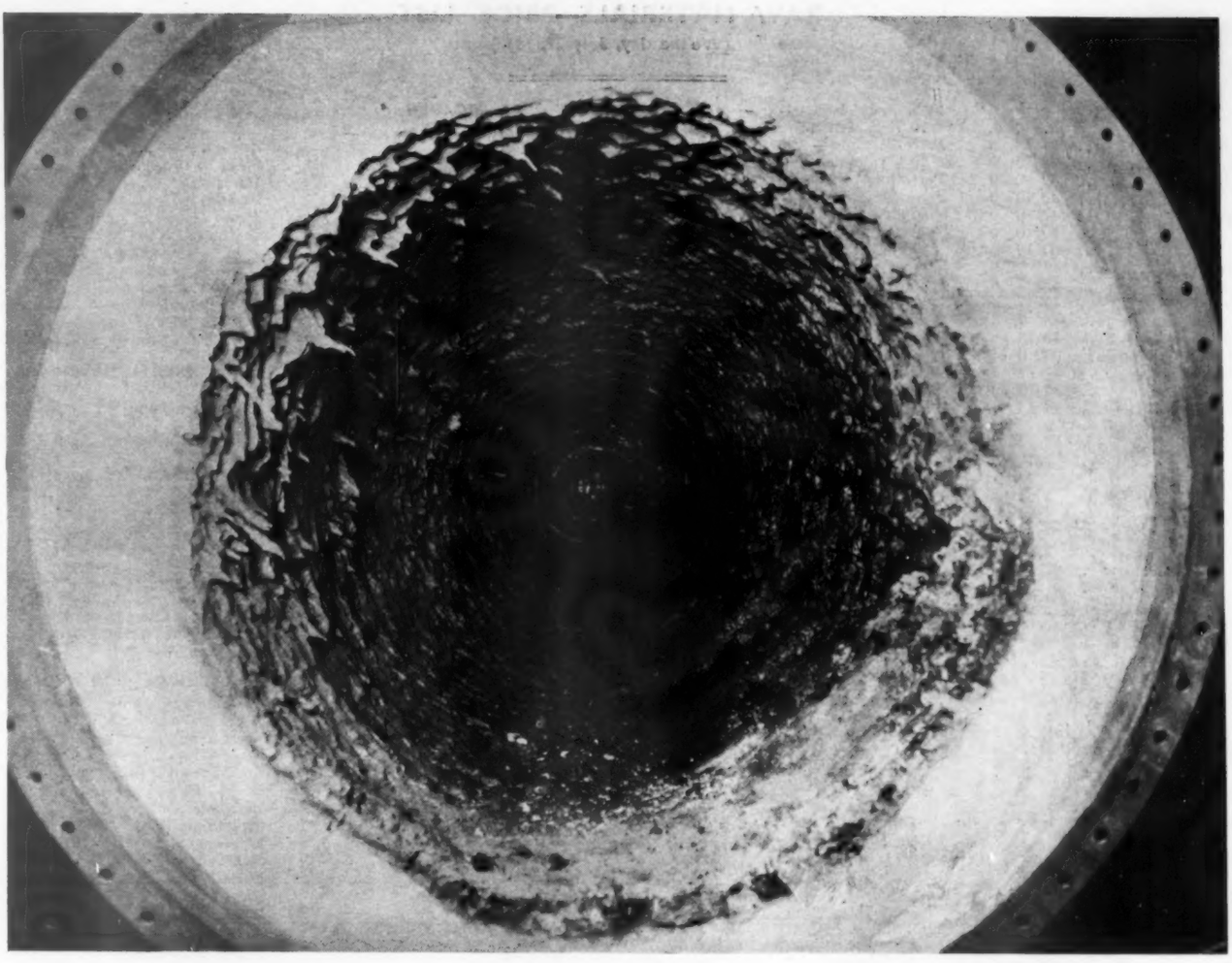
Day-to-day quotations :—

Soft Foreign (prompt).—Thursday, £16 7s. 6d.; Friday, £16 6s. 3d.; Monday, £16 11s. 3d.; Tuesday, £16 10s.; Wednesday, £16 8s. 9d.

Catalogues Received

Power Plant. J. Browett Lindley (1931), Limited, of Letchworth, Herts, have prepared an eight-paged brochure which is designed to indicate the various lines of power plant which they manufacture. Amongst these is a motor-driven two-stage air compressor fitted with an automatic unloading valve on the inlet side.

High-Tensile Steel. With the passage of time the brochures issued by the great steel companies more and more resemble Papers presented to scientific institutes, with the difference that the former are embellished by recourse to the art of the printer. Into this category enters one received from Colvilles, Limited, 195, West George Street, Glasgow, C.2. This brochure gives in technical language, illustrated by graphs and microsections, all the physical properties of "Ducol" steel. The only thing that is missing is the Table I of the technical Paper—that is, chemical composition of the samples used. The reviewer suggests that in these enlightened days there is no mystery as to analysis, and its ascertainment probably costs less than the preparation of a couple of tensile test-pieces. The brochure runs to 30 well-illustrated pages, and included at the end are several devoted to industrial applications. Our readers should realise that "Ducol" high-tensile steel is primarily a material of construction to be used in the wrought state, and no suggestion as to its suitability for castings is mentioned. The publicity department of Colvilles certainly merits congratulations on this very pleasing production.



950 tons of metal melted—

The above photograph shows the condition of an 04 grade Albino lining in a 5-ton Brackelsberg furnace after 255 heats. You will observe the lining has worn dark evenly and it is still approximately 8" in thickness. The 04 grade is specially produced for rotary furnaces, but there are other grades for lining cupolas, converters and ladles. These photographs are reproduced by courtesy of James Howden and Company (Land) Ltd.

ALBINO

ROTARY FURNACE LINING MATERIAL

Please write for further particulars to the sole manufacturers:

GENERAL REFRACTORIES LIMITED,

Genefax House, Sheffield, 10

Telephone: Sheffield 31113 (6 lines) Telegrams: "Genefax, Sheffield"

MANUFACTURERS OF HEAT RESISTING AND HEAT INSULATING MATERIALS OF EVERY DESCRIPTION.

RAW MATERIALS—PRICE LIST

(Wednesday, July 29, 1936)

COPPER

	£ s. d.
Standard cash	37 18 9
Three months	38 5 0
Electrolytic	42 0 0
Tough	40 10 0
Best selected	41 0 0
Sheets	70 0 0
India	50 12 6
Wire bars	42 7 6
Ingot bars	42 7 6
H.C. wire rods	45 17 6
Off. av. cash, June	36 7 2⅞
Do., 3 mths., June	36 13 0 1/16
Do., Sttlmnt., June	36 6 10⅝
Do., Electro, June	40 11 3
Do., B.S., June	39 19 2
Do., wire bars, June	40 15 4⅜
Solid drawn tubes	10½d.
Brazed tubes	10½d.
Wire	6½d.

BRASS

Solid drawn tubes	9⅜d.
Brazed tubes	11¼d.
Rods, drawn	8½d.
Rods, extd. or rlld.	5d.
Sheets to 10 w.g.	8d.
Wire	7½d.
Rolled metal	7½d.
Yellow metal rods	5d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5¾d.

TIN

	£ s. d.
Standard cash	184 0 0
Three months	180 15 0
English	184 0 0
Bars	185 0 0
Straits	187 10 0
Australian (nom.)	—
Eastern	188 5 0
Banca (nom.)	—
Off. av. cash, June	183 3 10⅞
Do., 3 mths., June	181 1 2½
Do., Sttlmt., June	183 5 8½

SPELTER

	£ s. d.
Ordinary	14 1 3
Remelted	13 10 0
Hard	11 15 0
Electro 99.9	16 1 3
English	14 15 0
India	12 15 0
Zinc dust	19 10 0
Zinc ashes	4 5 0
Off. aver., June	14 0 2½
Aver. spot, June	13 17 11

LEAD

	£ s. d.
Soft foreign ppt.	16 8 9
Empire	17 5 0
English	18 10 0
Off. average, June	15 4 3⅜
Average spot, June	15 3 4⅞

ALUMINIUM

Ingots	£100 to £105
Wire	1/3 to 1/4 lb
Sheet and foil	1/2 to 1/4 lb.

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	24 0 0 to 24 10 0
Do., V.M. ex-whse.	24 0 0 to 24 10 0
Rods	26 0 0

ANTIMONY

	£ s. d.
English	64 10 0 to 65 10 0
Chinese, ex-whse.	52 0 0
Crude, c.i.f.	24 10 0

QUICKSILVER

Quicksilver	11 7 6 to 11 17 6

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	8 17 6
45/50%	12 15 0
75%	17 17 6
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	4/6 lb. Mo.
Ferro-titanium—	
20/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£21 to £22
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	33 0 0
4/6% car.	21 10 0
6/8% car.	21 0 0
8/10% car.	21 0 0
Ferro-chrome—	
Max. 2% car.	33 10 0
Max. 1% car.	36 5 0
Max. 0.50% car.	37 5 0
70% carbon-free	9½d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	6/3 to 6/9 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese—	
76/80% loose	£11 5 0 to 11 15 0
76/80% packed	£12 5 0 to 12 15 0
76/80% export	(nom.) £10 5 0
Metallic manganese—	
94/96% carbon-free	1/3 lb.

Per ton unless otherwise stated, basis 2-ton lots.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 3/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£ s. d.	£ s. d.
South Wales—		
Heavy steel	3 2 0	to 3 3 0
Mixed iron and steel	2 18 0	to 2 19 0
Heavy cast iron	2 18 0	to 3 0 0
Good machinery	3 2 0	to 3 4 0
Cleveland—		
Heavy steel	2 17 6	
Steel turnings	2 0 0	
Heavy cast iron	3 5 0	
Heavy machinery	3 7 6	
Midlands—		
Light cast-iron scrap	2 12 6	to 2 15 0
Heavy wrought iron	3 5 0	to 3 7 6
Steel turnings	2 0 0	
Scotland—		
Heavy steel	2 17 6	
Ordinary cast iron	3 5 0	
Engineers' turnings	2 2 6	
Cast-iron borings	1 17 0	
Wrot-iron piling	3 9 6	
Heavy machinery	3 8 6	to 3 10 0

London—Merchants' buying prices, delivered yard.

	£ s. d.
Copper (clean)	29 0 0
Brass	19 0 0
Lead (less usual draft)	14 10 0
Tea lead	9 0 0
Zinc	8 0 0
New aluminium cuttings	74 0 0
Braziery copper	27 0 0
Gunmetal	28 0 0
Hollow pewter	130 0 0
Shaped black pewter	100 0 0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	77/6
,, No. 3	75/-
,, No. 4	74/-
Forge No. 4	74/-
Hematite No. 1	85/6*
Hematite M/Nos.	85/-*
N.W. Coast—	
Hem. M/Nos. d/d Glas.	85/6*
,, d/d Birm.	97/-*
Malleable iron d/d Birm.	125/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	77/-
,, No. 3 fdry.	80/-
Northants forge	74/6
,, fdry. No. 3	77/6
,, fdry. No. 1	80/6
Derbyshire forge	77/-
,, fdry. No. 3	80/-
,, fdry. No. 1	83/-
Scotland—	
Foundry, No. 1, f.o.t.	81/6
,, No. 3, f.o.t.	79/-
Cleveland No. 3, Glasgow	78/-
,, ,, Falkirk	75/-
Scottish hem. M/Nos. d/d	85/6*
Sheffield (d/d district)—	
Derby forge	74/6
,, fdry. No. 3	77/6
Lincs forge	74/6
,, fdry. No. 3	77/6
W.C. hematite	91/-*
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	83/-
Staffs fdry. No. 3	83/-
Northants fdry. No. 3	81/6
Cleveland fdry. No. 3	83/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	90/-
Clyde, No. 3	90/-
Monkland, No. 3	90/-
Summerlee, No. 3	90/-
Eglinton, No. 3	90/-
Gartsherrie, No. 3	90/-
Shotts, No. 3	90/-

* Subject to a rebate of 5s. per ton under certain conditions.

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.)	10 2 6	
Nut and bolt iron	8 10 0	to 9 0 0
Hoops	11 0 0	and up.
Marked bars (Staffs) f.o.t.	12 10 0	
Gas strip	11 0 0	and up.
Bolts and nuts, ¾ in. × 4 in.	15 15 0	and up.
Steel—		
Plates, ship, etc.	9 7 6	to 9 10 0
Boiler plts.	9 17 6	to 10 0 0
Chequer plts.	11 0 0	
Angles	9 0 0	
Tees	10 0 0	
Joists	9 7 6	
Rounds and squares, 3 in. to 5½ in.	10 0 0	
Rounds under 3 in. to ⅜ in. (Untested)	9 7 0	
Flats—8 in. wide and over	9 5 0	
,, under 8 in. and over 5 in.	9 10 0	
Rails, heavy	8 5 0	to 8 10 0
Fishplates	12 10 0	
Hoops (Staffs)	10 2 0	
Black sheets, 24g. (4-t. lots)	12 0 0	
Galv. cor. shts. (,,)	14 0 0	
Galv. flat shts. (,,)	14 10 0	
Galv. fencing wire, 8g. plain	15 0 0	
Billets, soft	6 2 6	
Billets, hard	7 2 6	to 7 7 6
Sheet bars	6 0 0	
Tin bars	6 0 0	

PHOSPHOR BRONZE

	Per lb. basis
Strip	10½d.
Sheet to 10 w.g.	11½d.
Wire	12⅜d.
Rods	11½d.
Tubes	14d.
Castings	12¼d.

Delivery 3cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	21.31
No. 2 foundry, Valley	19.50
No. 2 foundry, Birm.	15.50
Basic, Valley	19.00
Malleable, Valley	19.50
Grey forge, Valley	19.00
Ferro-mang. 80%, seaboard	75.00
O.-h. rails, h'y, at mill	36.37½
Billets	30.00
Sheet bars	30.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.95
Tank plates	1.90
Beams, etc.	1.90
Skelp, grooved steel	1.80
Steel hoops	1.95
Sheets, black, No. 24	2.50
Sheets, galv., No. 24	3.20
Wire nails	2.10
Plain wire	2.40
Barbed wire, galv.	2.60
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	30/- to 31/-
,, furnace	24/6 to 25/-
Durham foundry	24/6
,, furnace	21/6
Scotland, foundry	30/-
,, furnace	25/- to 26/-

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	18/9
,,	28×20 ,,	37/6
,,	20×10 ,,	26/9 to 27/-
,,	18¾×14 ,,	19/6
C.W.	20×14 ,,	15/6 to 15/9
,,	28×20 ,,	33/9 to 34/3
,,	20×10 ,,	22/7½ to 23/-
,,	18⅞×14 ,,	15/3 to 16/-

SWEDISH CHARCOAL IRON & STEEL

	£ s. d.	£ s. d.
Pig-iron	£6 0 0	to £7 0 0
Bars-hammered, basis	£16 0 0	to £16 10 0
Bars and nail-rods, rolled, basis	£15 15 0	to £16 0 0
Blooms	£10 0 0	to £12 0 0
Keg steel	£30 0 0	to £31 0 0
Faggot steel	£18 0 0	to £23 0 0
Bars and rods dead soft, st'l	£10 0 0	to £12 0 0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

	£	s.	d.	
July 23 ..	37	13	9	No change
„ 24 ..	37	13	9	„ „
„ 27 ..	37	16	3	inc. 2/6
„ 28 ..	37	18	9	„ 2/6
„ 29 ..	37	18	9	No change

Electrolytic Copper

	£	s.	d.	
July 23 ..	41	17	6	dec. 2/6
„ 24 ..	41	15	0	„ 2/6
„ 27 ..	41	15	0	No change
„ 28 ..	41	17	6	inc. 2/6
„ 29 ..	42	0	0	„ 2/6

Standard Tin (cash)

	£	s.	d.	
July 23 ..	189	15	0	No change
„ 24 ..	188	15	0	dec. 20/-
„ 27 ..	185	0	0	„ 75/-
„ 28 ..	179	10	0	„ 110/-
„ 29 ..	184	0	0	inc. 90/-

Tin (English ingots)

	£	s.	d.	
July 23 ..	190	0	0	inc. 5/-
„ 24 ..	188	15	0	dec. 25/-
„ 27 ..	185	10	0	„ 65/-
„ 28 ..	179	10	0	„ 120/-
„ 29 ..	184	0	0	inc. 90/-

Spelter (ordinary)

	£	s.	d.	
July 23 ..	13	15	0	dec. 2/6
„ 24 ..	13	13	9	„ 1/3
„ 27 ..	13	15	0	inc. 1/3
„ 28 ..	14	0	0	„ 5/-
„ 29 ..	14	1	3	„ 1/3

Spelter (Electro, 99.9 per cent.)

	£	s.	d.	
July 23 ..	15	15	0	dec. 3/9
„ 24 ..	15	13	9	„ 1/3
„ 27 ..	15	15	0	inc. 1/3
„ 28 ..	16	0	0	„ 5/-
„ 29 ..	16	1	3	„ 1/3

Lead (soft foreign, prompt)

	£	s.	d.	
July 23 ..	16	7	6	dec. 5/-
„ 24 ..	16	6	3	„ 1/3
„ 27 ..	16	11	3	inc. 5/-
„ 28 ..	16	10	0	dec. 1/3
„ 29 ..	16	8	9	„ 1/3

Lead (English)

	£	s.	d.	
July 23 ..	18	10	0	No change
„ 24 ..	18	5	0	dec. 5/-
„ 27 ..	18	10	0	inc. 5/-
„ 28 ..	18	10	0	No change
„ 29 ..	18	10	0	„ „

AVERAGE MONTHLY PRICES OF UNMARKED BARS (SOUTH STAFFS)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1901	8 0 0	7 10 0	7 5 0	7 0 0	6 10 0	6 10 0	6 10 0	6 10 0	6 15 0	6 15 0	6 15 0	6 15 0	6 17 11
1902	7 0 0	6 10 0	6 15 0	6 15 0	6 15 0	6 10 0	6 10 0	6 15 0	6 15 0	6 15 0	6 10 0	6 10 0	6 13 4
1903	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 7 0	6 5 0	6 9 4½
1904	6 5 0	6 5 0	6 5 0	6 5 0	6 10 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 2 11½
1905	6 5 0	6 5 0	6 0 0	5 17 6	5 15 0	5 15 0	5 15 0	6 0 0	6 0 0	6 5 0	6 15 0	6 15 0	6 1 10
1906	7 0 0	7 5 0	7 5 0	7 5 0	6 17 6	6 15 0	6 12 6	6 10 0	6 10 0	6 12 6	6 16 3	7 3 9	6 17 8
1907	7 3 9	7 5 0	7 5 0	7 5 0	7 5 0	7 7 6	7 5 0	7 7 6	7 7 6	7 7 6	7 7 6	7 5 0	7 5 11
1908	7 2 6	7 0 0	7 0 0	7 0 0	6 15 0	6 7 6	6 5 0	6 2 6	6 2 6	6 2 6	6 2 6	6 0 0	6 10 0½
1909	6 0 0	6 0 0	6 0 0	5 17 6	6 0 0	6 0 0	6 0 0	5 17 6	6 0 0	6 2 6	6 2 6	5 17 6	5 19 9
1910	6 2 6	6 3 4½	6 7 6	6 7 6	6 7 6	6 7 6	6 6 6	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 7
1911	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 10 0	6 12 6	6 16 6	6 7 0
1912	6 18 9	7 1 10	7 2 6	7 8 9	7 18 0	8 0 7	8 2 6	8 3 6	8 5 0	8 6 3	8 7 6	8 8 9	7 17 0
1913	8 11 6	8 10 7½	8 10 0	8 8 1½	8 2 0	8 0 0	7 17 6	7 11 6	7 8 9	7 5 6	6 18 1½	6 17 6	7 16 9
1914	6 17 6	6 15 7½	6 12 6	6 10 0	6 10 0	6 10 0	6 10 0	7 11 10½	8 0 0	7 12 6	7 5 7½	7 6 3	7 1 0
1915	7 11 6	8 5 11	8 8 9	9 6 0	10 3 2	10 19 2	11 12 6	11 13 1½	11 13 9	11 14 3	12 1 10½	13 0 9	10 6 0½
1916	13 7 6	13 10 8	13 12 9½	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 3 9
1917	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0½
1918	13 15 0	13 17 3	13 17 6	13 17 6	13 17 6	13 17 6	13 17 6	14 15 0	14 15 0	14 15 0	14 15 0	14 15 0	14 4 5
1919	15 10 0	16 5 0	17 15 0	17 15 0	20 15 0	21 0 0	21 0 0	22 0 0	22 0 0	22 0 0	22 7 6	22 12 6	20 1 8
1920	24 7 6	24 10 0	25 10 0	27 10 0	29 5 0	31 0 0	31 10 0	31 10 0	31 10 0	31 10 0	31 10 0	29 7 6	29 1 8
1921	26 17 3	25 0 0	23 0 0	21 0 0	19 0 0	18 5 0	16 0 0	16 0 0	15 14 0	14 0 0	13 6 8	13 0 0	19 4 5½
1922	13 0 0	12 3 9	11 14 0	11 11 10½	11 5 0	11 3 6	11 2 6	11 5 0	10 17 2½	10 16 3	10 13 0	10 12 6	11 7 0½
1923	10 16 10½	11 3 1½	12 2 6	12 8 9	12 11 6	12 1 3	11 15 11½	11 15 0	11 15 0	11 15 0	12 13 6	12 8 3	11 18 10½
1924	12 9 6	12 10 0	12 10 0	12 15 7½	12 17 6	12 17 6	12 17 6	12 17 6	12 17 6	12 14 0	12 12 6	12 12 6	12 14 3½
1925	12 12 6	12 12 6	12 12 6	12 12 6	12 12 6	12 7 6	12 7 6	12 7 6	12 4 6	11 18 6	11 13 9	11 13 0	12 6 2
1926	11 7 9½	11 5 0	11 5 0	11 5 0	11 3 9	11 3 9	11 5 0	12 0 0	13 0 0	*	15 7 6	12 19 0	12 0 2
1927	12 6 3	12 2 6	11 14 0	11 0 0	10 18 9	10 13 6	10 12 6	10 5 0	9 16 0	9 15 0	9 13 9	9 12 9	10 14 2
1928	9 12 6	9 12 6	9 11 0	9 10 0	9 8 4	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 3 6	9 1 3	9 7 0
1929	9 0 0	9 2 6	9 5 7½	9 9 4½	9 10 0	9 17 6	10 2 6	10 2 6	10 2 6	10 0 6	10 3 9	10 5 7	9 15 2½
1930	10 7 6	10 7 6	10 7 6	10 6 10½	10 6 3	10 5 0	10 2 6	10 2 6	10 2 6	10 2 6	10 2 6	10 2 6	10 4 7½
1931	10 2 6	10 0 0	10 0 0	10 0 0	9 18 1½	9 17 6	9 17 6	9 17 6	9 17 6	9 17 6	9 17 6	9 16 10½	9 18 0½
1932	9 15 0	9 15 0	9 15 0	9 15 0	9 13 9	9 11 3	9 10 0	9 10 0	9 10 0	9 6 3	9 5 0	9 5 0	9 10 11½
1933	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0
1934	9 5 0	9 8 1½	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 11 6
1935	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6
1936	9 12 6	9 15 0	10 2 6	10 2 6	10 2 6	10 2 6	—	—	—	—	—	—	—

* No quotation available owing to strike.

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

FOUNDRYMAN, practical, technical and commercial experience, wishes to represent first-class firm for sale of ferrous and non-ferrous castings in Birmingham and Midlands.—Box 808, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

METALLURGICAL Chemist, age 22, desires an appointment. Experience of ferrous or non-ferrous work. Excellent references.—Apply L. T. BEVERLEY, "Rutland," Elsma Road, Quinton, Birmingham.

SINGLE Man, aged 30, with experience of ironmongery trade, seeks situation in this line; any district. Excellent references.—Write W. GAMBRILL, 64, George Street, Reading, Berks.

LARGE Repetition Grey-iron Foundry requires young Foundry Executive to train for position as Assistant Foundry Manager. Excellent opportunity for young man with initiative. Applicant must have had practical experience in moulding and general foundry work. Apply, giving full particulars of practical and technical training, to Box 826, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

MAINTENANCE Foreman for steelfoundry plant consisting of cupolas, converters, cranes, shot blast, moulding machines, etc. Considerable scope exists for the advancement of the right man. Age 30-40.—KRYN & LAHY (1928), LTD., Letchworth.

METALLURGIST wanted to take charge of high-frequency melting plant on alloy steels. Preferably with some foundry experience. Excellent prospects for the right man. Applications, which will be treated in confidence, should give particulars of training and experience, age, and salary required, to Box 818, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

WANTED, in West of England foundry, Assistant Manager. Must have considerable experience in stove burner work and core-making. State full particulars, salary required, to Box 824, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of THE FOUNDRY TRADE JOURNAL.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

FOUNDRY Manager requires position or as Assistant. Young, practical moulder, excellent experience in managerial positions on general engineering and also repetition work. Cupola control. Sound technical training. (281)

SITUATIONS VACANT AND WANTED.—*Contd.*

MANAGER, age 40, practically and metallurgically highly qualified Engineer with 15 years' experience in large iron, steel, brass and aluminium foundries, desires responsible position with well reputed firm. (282)

IRONFOUNDRY Foreman desires position with progressive firm. Experienced in jobbing work, machine moulding, general engineering, estimating, cupola practice, etc. (283)

PROPERTY

MODERN Steelfoundry at Rotherham, main building 65 ft. by 150 ft. (erected 1916); complete with 10-ton crane. Site 1 acre. Siding on L.N.E. Rly. Adjacent canal.—Apply: GORDON, P.O. Box 98, Sheffield.

MACHINERY

WANTED.—Rotary Melting Furnace, 1 ton capacity. Also power Riddling Machine.—Box 800, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

NEW Dwarf Cupola, to melt 10 to 15 cwts. per hr. New Worm-geared Ladles, 5 tons, 25 cwts., 15 cwts. and 10 cwts. capacity. Ungeared Ladles, 15 cwts. and 10 cwts. capacity. Improved Cupola Spark Arresters.—T. DAVIES & SON, West Gorton, Manchester.

Tilghman Sandblast Barrel Plants; barrel sizes—60 in. x 40 in.; 36 in. x 20 in.; 20 in. x 30 in.

Tilghman Sandblast Cabinet Plants; 4 ft. 6 in. and 3 ft. 6 in. square (one for high pressure 70 lbs. per sq. in.); also small Cabinet 30 in. dia.

All complete with Air Compressors, etc.

Gas and Air Mixer by Sharpe & Preston, 2-in. outlet.

Six Osborne Pneumatic Jolt Press Moulding Machines, size 75J.

Three Mumford Yoke Headpress Pneumatic Moulding Machines.

Two Herbert Whizzer Sand Disintegrators.

Two Brealey Type ditto.

Heavy Double-ended Grinding Machines by Rowlands, Luke & Spencer, etc.

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500 Electric Motors, Dynamos, Rotary Converters, etc.

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Rateau patent TURBO-BLOWERS (Fraser & Chalmers) for 35,000 cub. ft. per min. at 14 lbs. pressure.

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TRY Southport Sand, the best for Cores. Quick deliveries by road. Any quantity. Sample free.

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SAND MERCHANT,
SOUTHPORT.

MISCELLANEOUS—*Continued*

WORK WANTED.—Firm with number of moulding machines open to take on Repetition Castings, Iron, Gunmetal, etc.—SHERVELL, LTD., Engineers and Founders, Unicorn Road, Portsmouth, Hants.

PATTERNS IN WOOD AND METAL for all branches of Engineering. Moulding methods carefully considered.—FURNESTON & LAWLOR, Letchworth.

'Phone: 287 SLOUGH

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Two Tabor Modern Jolt Squeeze and Pattern Draw Machines for boxes 20" × 14"; as new. Price £65 each.

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One genuine OSBORN Hand Machine. Price £28.

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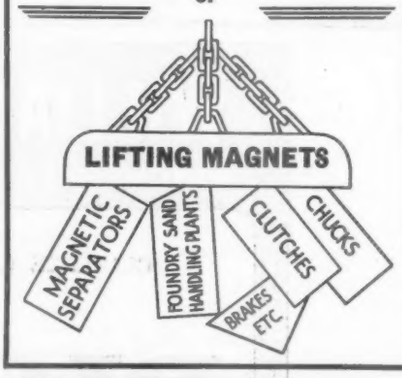

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